ABC WEAPONS, DISARMAMENT AND THE RESPONSIBILITY OF SCIENTISTS

Report on an International Conference
the World Federation of
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Report on an International Conference of the
World Federation of Scientific Workers
Berlin (GDR), 21st–23rd November 1971

Published by the Executive Council of Gewerkschaft
Wissenschaft for the World Federation of Scientific Workers

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Printed in the German Democratic Republic
by Grafischer Grossbetrieb
Völkerfreundschaft Dresden
2417-2

Preliminary Remarks

"The Dangers of ABC Weapons, the Real Possibilities of Disarmament and the Responsibility of Scientists" was the subject of the International Conference held by the World Federation of Scientific Workers with the assistance of its member organisation in the GDR, the Gewerkschaft Wissenschaft, in Berlin (GDR) from November 21–23, 1971. The World Federation of Scientific Workers had invited more than 100 representatives of various branches of science–physicists, chemists, biologists, physicians, historians, economists, lawyers and disarmament experts–from 21 countries for an exchange of ideas. In view of the great general significance of the subject the conference was also attended by a number of students and teachers of the GDR. In addition, a number of international organisations were represented by observers or participants (see List of Participants).

It was assumed that all conference participants were familiar with the problems arising from the continuous increase of the destructive potential and the introduction of new arms systems. That knowledge was completed by carefully prepared material made available to the conference in numerous copies by the Stockholm International Peace Research Institute ("SIPRI Yearbook of World Armaments and Disarmament", 1969/70, and "The Problem of Chemical and Biological Warfare", volumes I, IV, V, published by SIPRI, Stockholm, New York 1971). All participants were furthermore provided with a collection of tables specially prepared for the conference (Tables: nuclear arms; chemical and biological weapons and substances similar in structure and effect. By M. von Ardenne, F. Geissler, I. Hasenheyer, K. Lohs and H. Pöche. Berlin 1971).

The number and volume of papers and the overlapping, inevitable in view of the breadth of the subject, made it necessary to shorten the papers. It is to be hoped that this will make the material available in an even more appropriate form thereby bringing it to a larger circle of people interested in problems linked with the stabilisation of peace. This Report contains all papers submitted in a more or less abridged form and presents, in the fourth section, a survey of the discussion which occupied an important place at the conference. Deviating from the events of the conference, where M. Steenbeck (GDR), B. T. Feld (USA), C.-G. Hedén (Sweden) and K. Lohs (GDR), J. Moch (France), W. G. Trukhanovsky (USSR), D. R. Inglis (USA), P. Cot (France) and J. Kuczynski (GDR), K. H. Wirzberger (GDR), F. Calogero (Italy) and P. Biquard (France) delivered main or introductory reports on various topics, these papers were included in alphabetical order of the names of authors in the three large subject headings of the conference.

We hope that this publication will serve to promote the struggle which is at present developing for the safeguarding of peace in Europe, for an end of the arms race and for disarmament in the world—aims which the World Federation of Scientific Workers has been pursuing since its foundation in 1946, so that its major objective—the improvement of human welfare by the application and development of science—might be attained. May this Report help above all to reinforce the movement for an All-European Security Conference and for a World Conference on Disarmament and to raise the general level of knowledge of the problems involved.

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From the Opening Address

by H. Budzislawski (GDR), Vice-President of the World Federation of Scientific Workers

...What is new about this Conference? First, the widely held opinion that war should be made increasingly dangerous and that the alleged beast in man should be kept in check and tamed rather than civilized by means of useful activity–this concept of preventing wars by deterrence is no longer considered sufficient; it has been rejected and replaced by the demand for "Peace through arms limitation and disarmament".

Second, it seems to me that scientific workers quite rightly continue to consider themselves specialists, experts in one field, but now take a large step forward amalgamating the scientific, technological and sociological ways of thinking into one–which is also reflected by the three main topics of this conference. Their ivory tower is pushed further into the background, their social responsibility comes closer to the fore...

ABC Weapons, Disarmament and the Responsibility of the Scientist

Opening Speech by E. H. S. Burhop, F. R. S.,
President of the World Federation of Scientific Workers

This conference is meeting after the first quarter century of the atomic era. The history of this period has been dominated by the arms race, by a continuing series of local wars which have more than once threatened to explode into the all out nuclear confrontation that could encompass the doom of mankind. The arms race has escalated again and again with the revelation of new technical developments by one or other of the nuclear powers. Each time the cost of armaments has increased until at present the total annual world expenditure on arms amounts to $200,000 M, a sum about three times as large as the gross national product of the United Kingdom. But even with this great expenditure of wealth and treasure true security remains a chimera. The past seven or eight years have been a period of quasi stability since both the major nuclear powers have attained second strike capacity but neither have been in a position to destroy the retaliatory capacity of the other in a sudden surprise blow.

Now however we are entering a new period. The development of the anti ballistic missile (ABM) and multiple independently orbited re-entry vehicle (MIRV) systems will destroy this stability and may give one or other or both nuclear powers first strike capacity. This will be a period of great danger when we are likely to hear once again serious discussion of the pre-emptive strike as an instrument of policy. If we can survive this period of danger that appears to lie close ahead we may again perhaps eventually reach another level of quasi-stability with both nuclear powers deploying extensive ABM and MIRV systems. But the level of expenditure on arms will have increased by an order of magnitude and this will buy less security than at present.

Clearly mankind cannot exist indefinitely in the twilight world of the escalating nuclear arms race. A sort of peace may continue for a decade or even for a generation but how can one believe that we can exist for long in the shadow of the holocaust?

Even without nuclear war the succession of local wars are fought using most repugnant weapons–napalm, anti-personnel weapons, defoliants while the constant threat of the use of nerve gases and other more devastating chemical weapons looms in the background.

Other crises for mankind loom ahead in the near or middle distance, crises associated with the destruction of the environment, with the squandering of vital resources, with the population explosion. But the crisis presented by the arms race is upon us here and now. It exacerbates the environmental and preservation crises. It will engulf us unless we succeed in solving it.

The key to the solution of the problems of the arms race is, simply, disarmament. The arms race differs from the other crises facing mankind. They are all long-term phenomena. It will take generations to level off the explosive population growth, to find substitutes for the scarce natural resources our civilization is consuming at such a prodigal rate, or to solve the pollution problems that go hand in hand with a modern industrial civilization. But the crisis of the arms race will be solved by stopping it and turning to disarmament. Of course this is facile talk because before disarmament can become a reality the conditions that brought about the arms race, especially the race in ABC weapons will need to be recognised and remedied. The fears for the security of one's society may be imponderable, vague, irrational, psychological, but they are very real and impressed on the minds of large sections of the people. Just because they are largely psychological and without real substance, this makes them the more intractable. Unfortunately in many countries, venal organs of propaganda, an unscrupulous section of the press, fan the flames of suspicion and mistrust and perpetuate the sense of insecurity. Too many interests have a stake in the arms race, profit by it, and fear that in a disarming world they would lose their privileges, their profits or even their jobs. It is important for us to show that a disarmed world does not imply a world with a depressed economy.

Nevertheless the sense of insecurity that makes it possible for peoples to acquiesce in the arms race can be influenced by signs of agreement and understanding between the nations concerned. This is why the partial measures of agreement that have been achieved – the partial test ban treaty, the non-proliferation treaty and the others, are important. Unfortunately none of these measures are really disarmament measures. They are measures aimed at limiting the further rate of increase of armaments, of preventing an already disastrous situation becoming even more disastrous if that were possible. The psychological effects of these limited agreements have largely been lost because they have not quickly been followed by real measures of disarmament.

The search for agreement on the control and limitation of weapons of mass destruction and on general disarmament has been going on both inside and outside the United Nations ever since the end of the Second World War. Compared with the efforts, the achievements have been minimal. Clearly the organs that have been set up to discuss disarmament have proved inadequate or unsuitable for the task. That is why we must look for new initiatives. I am sure this conference will be examining with great seriousness such proposals as those of the Soviet Government for the convening of a World Conference on Disarmament, involving all governments, in 1973, for the convening of a European Security Conference and of other regional conferences that would, among other things, relate the problems of security, arms control and limitation in a given region with the general problem of disarmament.

All the modern weapons with which we are particularly concerned at this symposium have in common the feature that their development depends on the most advanced and sophisticated science and technology. Without the co-operation of scientists and technologists their further development could not continue. It is therefore most appropriate that at this conference we shall be discussing not only the problems of the weapons and of disarmament but also of the responsibility of the scientist.

It has been stated that more than 60 per cent of the total expenditure on research and development in a modern industrial state is used up in research and development for weapons, weapons systems and associated problems. The most sophisticated modern technology is applied almost entirely in the arms and aero-space industries, much less to satisfying the requirements of ordinary people in our society and hardly at all to meeting the needs of the developing countries. Since our brightest scientists are attracted by the challenge of the most sophisticated and technically advanced science and technology many of them are to be found working in defence establishments and in the industries that serve them. Many scientists are caught in the web of their vested interests in the continuation of the arms race, which blunts their sense of social responsibility. They are victims of the Military-Industrial Complex about which President Eisenhower warned in January 1961 in his remarkable farewell address to the nation at the end of his eight-year term of office:

> *"In the councils of Government we must guard against the acquisition of unwarranted influence, whether sought or unsought, of the military-industrial complex. The potential for the disastrous use of misplaced power exists and will persist."*

The military-industrial complex was developing an influence "felt in every city, every State House, every office of the Federal Government". He was referring to the scene in the United States but I am sure that a similar phenomenon, although perhaps in different form has arisen elsewhere. I recently reviewed a book "The Military-Industrial Complex" by Sidney Lens which discusses the situation in the United States ten years after Eisenhower's warning.

Not only are scientists directly employed in defence industries enmeshed in the web of vested interest. Many academics are also deeply involved. It may be a difficult decision for a university physics professor, for instance, who is offered a new laboratory provided he will allow part of the research programme of the laboratory to be oriented along lines suggested by the army. He will rationalise by arguing that even though he himself has some qualms it would be wrong for him to stand in the way of his colleagues getting the equipment they need.

Lucrative consultancies are offered so that the salary of a professor ready to co-operate may be several times that of his colleagues who will not prostitute their talents in this way. To their shame many university laboratories have fulfilled a key role in the development of defoliants, or fire, gas and anti-personnel bombs for the war in Vietnam. Leading universities like the Massachusetts Institute of Technology (MIT), John Hopkins, Stanford etc. would be cut down drastically in size and prestige if their grants from military sources were withdrawn. For MIT, for example, in 1967-8, of its budget of $170 M, no less than $120 M came directly from military sources. As Clark Kerr, the former President of the University of California put it,

> *"intellect has also become an instrument of national purpose, a component part of the military-industrial complex".*

In referring specifically to the situation in the U.S.A. I do not wish to imply it is unique to that country. The same kind of tendencies are present in my own country. The direct harnessing of the universities to fulfil military needs and their dependence on such sources for finances has not gone nearly so far largely because of the tradition of free publication of all research work carried out in university laboratories. Many university departments in the United Kingdom have been only too willing to accept grants for research from the U.S. Army, while the practice of accepting consultancies from defence establishments is quite common. The main reason that it is possible to quote the situation in the United States is that the material is well documented and available and we owe a debt to our American colleagues who are responsible for this. All scientists must search their consciences regarding the real position in their own universities. If our appeal to scientists to examine their sense of social responsibility is to be a credible one this conference should pay attention not only to general discussions about the economic consequences of disarmament but specifically to the problem of providing resources for peaceful developments involving the most challenging and advanced science and technology, worthy of the intellectual calibre of our most talented scientists.

The World Federation of Scientific Workers was established in the aftermath of the first nuclear bomb. The sharpness of the contrast between the peaceful potentialities of the use of nuclear energy and the frightening reality of its actual use in producing weapons of previously unimaginable horror was one of the main motivating influences leading to its formation. This theme runs through the basic documents of the Federation, its Charter and the statement of aims in its Constitution.

Throughout the quarter century of its existence the Federation has spoken out again and again for general disarmament and the limitation and abolition of nuclear weapons under conditions of effective control. At an early stage it took up the question of the abolition of nuclear tests, first proposed by David Inglis whom I am particularly pleased to see with us here today. Its brochure "Unmeasured Hazards" which argued the case for a nuclear test ban was published in 1956 in nine languages and, I believe, played a part in preparing public opinion in several countries on this issue. It sent a delegation in 1959 to Moscow where it was received by Mr. Khrushchev. The delegation argued the case for the urgency of the conclusion of a Nuclear Test Ban Treaty. We requested also that this delegation of scientists should be received by President Eisenhower and Prime Minister Macmillan but these requests were not granted.

Our Federation is proud of the initiative it took in the steps leading up to the foundation of the Pugwash Movement and in the organization of the first

Pugwash Conference on Science and World Affairs in Canada in 1957. Ever since 1952 support for the convening of such a conference had been a main policy aim of the Federation. The inclusion of a paragraph in the Russell-Einstein statement of 1955 specifically calling for the convening of a conference of leading scientists to discuss and draw attention to the nuclear dangers was directly a result of a suggestion of Frederic Joliot-Curie, our Founder-President, in the course of discussions with Bertrand Russell in the spring of 1955 while our late president, Cecil Powell, as well as myself were each members of the organizing comittee of the first Pugwash Conference. There is no doubt that throughout the years the Pugwash movement has played a positive role in the movement for disarmament and the control of nuclear weapons.

I hope this conference will suggest further measures which the Federation can take in this field to help to break through the obstacles which are holding up further progress...

This conference would have been very close to the heart of our former dear colleague, J.D. Bernal, whose death last September after a long illness, was a great blow to our Federation and to the whole progressive movement among scientists. Apart from the fame of his creative scientific work which marked Bernal as one of the outstanding scientists of our generation, Bernal devoted his life to the problems of disarmament and of the need to realise in the developing countries, the potentialities made possible by the advance of science and technology. Bernal was one of the greatest thinkers of his time. He played a key role in the foundation of the Federation and he drafted its Charter. We are proud that it was such giants as Joliot-Curie, Powell and Bernal who guided the work and policy of the Federation for many years. In 1964 Bernal wrote:

> *"If we can survive the dangers of the immediate present we have every chance of realising a world so different from anything we have had before that the transition is greater than any which have occurred since the first appearance of humanity... Between that world and the present, however, we clearly have to pass through a transitional period which will be one of great danger... The operational problem remains of how to effect that transition with the minimum of strain and destruction."*

These thoughts provide a measure of the magnitude and importance of these problems and of the responsibility we bear in trying to find a solution to them. In these discussions the wisdom, the spirit and the example of Bernal will be constantly in our mind as we turn to consider the weighty issues before this conference.

Welcoming Address

A. Wilke, Secretary of the National Executive of the
Confederation of Free German Trade Unions

Please allow me on behalf of the National Executive of the Confederation of Free German Trade Unions (FDGB), the largest organization of the working class in the German Democratic Republic, to welcome you most cordially to Berlin, our capital.

Your Conference is to deal with a topic which is so important for the present and future of humanity as well as for maintaining and securing peace, namely "The Dangers of ABC Weapons, the Real Possibilities of Disarmament and the Responsibility of Scientists".

The highest task of the citizens of our socialist state, a task that is anchored in our Constitution, is to do everything in their power to make a constructive contribution to maintaining and securing peace. This great task, which the population of the GDR has set itself, is at the same time the task and the aim of the trade unions in the GDR. It is the express wish of the blue-collar workers, white-collar workers and scientists organized in the ranks of the Confederation of Free German Trade Unions that an All-European Conference on Security and Cooperation be convened as soon as possible without any preconditions being stipulated. The FDGB considers the efforts being made to obtain world-wide disarmament and European security to be an essential factor for the social security of all working people. For this reason we, for our part, are doing all we can to overcome all the obstacles and difficulties which still lie in the way of securing lasting peace in Europe.

By meeting their responsibility for further raising the working people's material and cultural standards of living–on the basis of a high growth in production and in labour productivity while at the same time making best possible use of scientific and technological progress–the trade unions are making an important contribution to consolidating, strengthening and developing our first German state with peaceful aims, the GDR.

Our trade unions have repeatedly stressed the great responsibility borne by science and scientits for maintaining and securing peace as well as for developing prosperity among all working people. Thus it is no coincidence that our scientists, our university teachers and those belonging to scientific institutions have joined together in the Union of Scientific Workers within the FDGB. In our country a close alliance between the working class and the intelligentsia has been formed. Together with the farmers in the GDR the working class has created all the preconditions which allow the results of scientific work to be used for the case of peace, humanism, social progress and the well-being of the people.

We consider the fact that the Conference of the World Federation of Scientific is being held in Berlin, capital of the German Democratic Republic, to be a sign of the trust shown to the GDR and its trade unions. Please rest assured that all our trade union members follow all movements and endeavours which serve general and complete disarmament, security and peace for the peoples with great attention and lively interest, and that they give their solidarity and support to such movements and endeavours. The main concern of this Conference arranged by the WFSW, for which you are all gathered here, fully corresponds to the tasks and aims of the trade unions in the GDR.

The Confederation of Free German Trade Unions fully appreciates the fact that scientists are becoming more and more conscious of their responsibility for the future of makind and that they are coming more and more to recognise that the working class is their natural ally in their endeavours to meet this responsibility. I wish your Conference much success and positive results in the interest of our common cause–general and complete disarmament and the securing of peace.

The Dangers of ABC Weapons

The Dangers of ABC Weapons

M. Atia, A. Fahmi, M. Hamdy, ARE

ABC weapons include atomic (nuclear), biological (bacteriological) and chemical weapons. They are called weapons of mass destruction in view of their effects on the life of human beings, animals and plants and on the physical environment, in addition to their psychological effects . . .

(In the following some aspects are briefly characterised.)

We all know about the horrible after-effects of A-bombs inflicted on Japanese victims.

Some chemical substances, e.g. Yperite, which is also described as radiomimetic agent, may even cause cancer. The plant killers used in Vietnam may be the immediate cause of chromosome mutations and deformations in newborn babies, if their mothers were exposed to these chemicals during pregnancy.

Biological weapons may also cause diseases in young children which affect the heart and the central nervous system.

The effects of nuclear weapons may extend to a radius of hundreds of kilometres and cannot be controlled. Clouds of sprayed toxic chemicals may spread over a radius of more than 10 kilometres, threatening life and carrying death to vast areas by polluted winds.

The effects of biological weapons however are not limited in their scope and may reach any part of the world.

The question, therefore, arises whether it is human to use such weapons. We think it is an inhuman crime.

Let us now view the matter from a different aspect, since grave dangers arise from the production and possible use of these weapons in developed and developing countries, regardless whether for offensive or defence purposes. It is of the utmost importance to discuss this problem from the point of view of the developing countries. These countries suffer to a large extent from malnutrition, diseases, housing shortage and a very low standard of hygiene. The most important factor in those countries is the bad economic situation. Many people are weakened by malnutrition and their powers of resistance are reduced, so that they are particularly susceptible to the effects of ABC weapons.

In particular the civilian population is unprotected and if such countries were attacked the losses would be very great. In developing countries there are very bad conditions of hygiene and few opportunities for medical attendance, so that there are neither adequate possibilities for prevention nor for cures.

Finally we come to the most important factor–the bad economic situation. From the economic view-point the costs involved in the production or possession of such weapons impose a heavy financial burden, since the storage, testing, maintenance and transport of the weapons, as well as protective measures and medical services need to be taken into account. In addition the restructuring of factories or laboratories serving the production of civilian goods for the population for military production purposes would lead to a shortage of goods for civilian requirements.

In addition, extremely costly air-raid shelters for the population would be needed. Such shelters would have to be built according to the most precise instructions, envisaging cleaning, ventilation and/or air conditioning systems. Otherwise each individual would have to be provided with a mask, protective gloves, protective clothes and special boots to be carried at all times ready for use as soon as the warning is given. The cost of this would be enormous, especially as we know that some kinds of protective measures lose their effectiveness after a time and would have to be improved or replaced.

In spite of all these precautions well functioning detectors and a higly efficient warning system would have to be available, in order to keep losses as low as possible. Vast quantities of sterilisers would have to be available everywhere and at all times. Some of these substances decompose and lose their effectiveness, even if correctly stored. Sterilising apparatus and equipment would need to be distributed throughout the whole country. The costs of medical services to treat the injured–including the training of personnel, a wide network of facilities for constant and extensive medical attendance, specially equipped hospitals etc.–would present an extremely complicated problem. It would have to be considered among other things, that certain drugs decompose in the course of time and may therefore only be administered within the period of prescribed duration. Civil defence plans would have to be drawn up, which could be put into immediate, efficient operation.

In recent times chemical warfare has been extended by the introduction of additional kinds of toxic chemicals such as herbicides, dessicants and defoliants. The example of Vietnam shows the extent of the losses caused by these substances and which effects they have on the country's economy. The most important crop of the country–rice–is being destroyed and the soil is made barren for an indefinite period. Although protocols on the prevention of the use of ABC weapons have been signed and conferences have been held on peace and disarmament, the Americans are continuing their crimes in Vietnam.

These agreements should also be extended to chemical weapons such as incendiaries (napalm and other viscous fuels, thermite etc.), to incapacitating substances (irritant gases), chemical and biological plant killers (herbicides, dessicants, defoliants, etc.), hallucinogenic and psychomimetic substances.

Finally we intend to support disarmament programmes through the medium of the World Federation of Scientific Workers, and there should be a group joining international institutions, attending disarmament conferences and addressing a resolute appeal to all countries, in particular to scientific workers, demanding the prohibition of the use and production of ABC weapons, including incendiaries, incapacitating, plant killing and psychomimetic substances.

Some Long-Term Effects of Chemical and Biological Weapons

T. Bakács, Hungary

(In the first part the contribution dealt with the world-wide changes in the ecological equilibrium noted in the 20th century, as a result of accelerated urbanisation, successful combat against epidemics, the rapidly advancing penetration of agriculture and other domains by chemicals leading to immediate or gradual injuries to health.)

One of the important things to note is that if chemical and biological weapons are applied man will be much more "vulnerable" in an environment that has been lastingly damaged by such long-term effects; it will be easier to attack him via his environment.

The short-term effects, such as the toxic effect of war gases or the effects of bacteriological weapons causing epidemics, can be explained in a relatively easy manner. It may, therefore, suffice here just to mention them. It is, however, rather more difficult to assess the long-term effects to be expected; it is more difficult to follow up the chain reaction of events, since it proceeds rather more slowly and sluggishly...

I should like now to deal with the complicated ralationships that could contribute to further disturbing the ecological balance, through long-term effects, through a certain chain reaction whose aims are of a military nature; army leaders would want to make use of these effects in order to deliberately change the ecological balance to the disadvantage of man and in order to cause damage to the population under attack. These hostile intentions, which are aimed at a negative change in the ecological balance and against man, may be materialised in the following way:

1. The attack may be directed against man's food supply,
   a) by proliferating certain plant diseases;
   b) by proliferating communicable animal diseases. Another possibility of hostile attack is
2. by causing mass epidemics (either directly or indirectly through their vectors), which science has been able to erase, restrict or, at least, restrain and which could, once again, become a threat to the human population.

The easiest way of disturbing the ecological balance to the disadvantage of man is by interrupting the food chain. From the different possibilities at his disposal the enemy will select the "most suitable one" for this negative aim, i.e.

that of eliminating the possibilities of food supply, habitation and subsistence. In this connection the most important question is: which plant epidemics with a widespread effect can be used most easily for military purposes?

Therefore it was necessary to select communicable endemic plant diseases which can be rendered epidemic—especially if the environmental and other conditions are favourable—thus considerably decreasing the yields, or even destroying all the crops attacked.

Their application will be even more effective, if the climatic conditions (air humidity and isolation) are favourable and if the wind carries the pathogenic agents (in most cases its spores) over long distances so that the epidemics spread over a large area.

One of the possibilities which have been known for a long time is spreading of rust of cereals, or more accurately, spreading of its different species (stem rust of cereals, black stem rust and yellow rust).

Rust

Due to its epidemic proliferation and its long-term effects, rust of cereals with its different species is one of the most dangerous plant diseases, which can be applied as an excellent, very effective biological weapon—especially if the spores are spread purposefully by spraying them under favourable climatic conditions (wind, relative humidity and insolation)—in order to damage food supplies for a very long period of time. If all these "favourable" conditions coincide, the ways and means of controlling the disease will be rather restricted and would take a long time to come into effect. (It is very difficult to verify that epidemics have been proliferated artificially). Since it is relatively easy to hit the target rust of cereals may be regarded as an extremely suitable biological weapon (due to each separate property and its properties as a whole).

The plant epidemics caused by rust of cereals may have incalculable consequences—especially in those countries which are encumbered by population explosion, for in these countries there is already a lack of foodstuffs anyway. If, taking into account their quantitatively as well as qualitatively insufficient supply of foodstuffs, they had to suffer even greater scarcity, they could be threatened with genuine famine that would kill hundreds of thousands of people already living on the verge of malnutrition.

The Colorado beetle

This destructive insect first appears in separate and small foci which seem independent of each other. After mass propagation the small foci spread out, but are not yet coherent. Finally the large foci unite to form still larger ones which are then coherent and thus cause tremendous damage to potato crops...

When the weather is extraordinarily dry the Colorado beetle can destroy as much as 80 per cent of the crop. As there are no resistant potato species control is quite difficult and only possible by means of chemicals. The combat commands realized the possibility of destroying this plant, which is indispensable for human beings, by means of destructive insects and thus using, in effect, a long-term effective biological weapon which changes the ecological balance.

Defoliating agents

This term covers different chemical compounds known to the forester as defoliants and to the farmer as weed killers. Due to their common characteristics industry calls these chemicals herbicides and/or siloicides.

The best known compounds of this group are Picloram and Cacodylic Acid which have been widely used as biological weapons in Vietnam since 1967–1968. Their short-term and direct effects are not toxic for higher warm-blooded animals. But due to their long-term effects they are dangerous and can harm warm-blooded animals and even people who live in the affected area.

The chemicals Picloram and Cacodylic Acid are not selective in their effect, they destroy all the leaves and twigs with which they come into contact. When using them in spray form on an oil basis they exterminate the whole vegetation, from the ground to the tree tops... In order to increase the effect during warfare the exterminated vegetation can be set on fire by bombs and thus the ecological damage increased.

From 1967 to 1968 about 636 million kg of herbicides were dispersed over an area of approximately 4 million hectares in Indochina. The result of this action was that not only the leaves of plants, but also the trees, rice seeds and other useful plants were destroyed, insects and birds died of hunger, and even man suffered greatly since he was deprived of his elementary vital needs. Very rare animal species lived in South East Asia before these chemicals were used. Large mammals, as, for example, elephants, tigers, wild boars, deer, rhinoceroses, anthropoid apes etc. Rare species of cattle also lived here, and a very rich bird population could be found. Numerous invertebrata (small sea crayfish, crabs etc.) lived in the seas. The defoliants, due to their long-term effects, did great harm to this diverse population. A reporter of the "New York Times" wrote the following:

> *"In numerous areas there is not a sign of life; wherever the largest battles took place the soil has been turned into a desert and laid waste "*

Many animals such as deer, tigers, elephants, apes and wild boars moved out of Vietnam into Cambodia and Laos. Rhinoceroses are no longer to be seen there; military operations have also driven them away.

The following is a list of chemicals used by the USA in South Vietnam:

Table I

Composition and characteristics of the herbicides used for military purposes:

Agents	*Composition*	*Percentage/ Weight*	*Composition of the spray lb./gallon*	*Aim*
"Orange"	n-butyl ester 2,4-D	50	4.2	Defoliation of forests, bushes and broad-leaved cultivated plants
	n-butyl ester 2,4,5-T	50	3.7	
			7.9	
"Purple"	n-butyl ester 2,4-D	50	4.2	General defoliation; interim agent used alternatingly with "Orange"
	n-butyl ester 2,4,5-T	30	2.2	
	Isobutyl ester 2,4,5-T	20	1.5	
			7.9	
"White" (Tordon 101)	Tri-isopropanolamine salt, 2,4-D	?	2.0	Defoliation of forests, long-term jungle control, retardation of bush growth
	Tri-isopropanolamine salt, picloram	?	0.54	
			2.54	
"Blue" (Phytar 560-G)	Sodium cacodylate	27.7		Rapid defoliation, short-term destruction of grass-covered areas and rice fields
	Cacodylic acid	4.8	3.1	
	Water; sodium chloride	balance		

Table II

		Spread of aerosol/year acres		
		Defoliation	*Crop destruction*	*Total*
	1962	17,119	717	18,836
	1963	34,517	297	34,814
	1964	53,873	10,136	64,009
	1965	94,726	49,637	144,363
Jan.–June	1966			495,637
	1966	775,894	112,678	888,572
Jan.–Sept.	1967	843,606	121,400	965,006

During military application these chemicals were sprayed as close as possible over the foliage (the normal spraying distance amounted to 50 metres) and relatively slowly (240 km/h). Due to the turbulence of the air an aerosol was formed in which the herbicide droplets had an average diameter of 300 μ . The aerosol then sinks and spreads over the forest in an approximately 75 m-wide zone. The climatic and air stream conditions can considerably increase the effectiveness of the herbicide aerosol.

The time which has passed since defoliants were first used is relatively short and the extent of the actual ecological damage cannot yet be fully assessed. We already know, however, that a destroyed mangrove forest needs at least 20 years to regenerate. In the meantime the soil quality can be damaged to such a degree (due to loam formation, increased erosion, damage to the microflora and microfauna of the soil which reduce its biological value) that the actual damage is even much greater. Furthermore, the long-term effect is also increased by the fact that picloram can be detected in the soil even after one year has passed.

Official reports from the United States recognized a part of the established facts. They admitted that certain changes would occur in the ecological balance and that these changes were of a long-term nature, but they maintained that they did not cause irreversible damage. The official statements are disputed by many scientific institutions in the United States. Thus, for example, the American Association for the Advancement of Science adopted a resolution three years ago in which it expressed its concern about the military use of chemical agents and defoliants, demanded an investigation and stated the following:

> *"...We do not at all share the self-confidence of the State Department, especially regarding the arsenic compounds (cacodylic acid), when it alleges that the herbicides used in Vietnam do not have damaging effects..."*

Military use of herbicides shows clearly that in comparison to the short-term effects which affect vegetation, the long-term ecological after-effects are the more complicated and possibly also the more dangerous ones. The long-therm effect starts off a chain reaction of forces even after the attack which carry on exercising their effects. This is caused by a hardly detectable mechanism. Thus the results are difficult to determine and control.

The biological weapons with long-term effects have—as the examples have shown—a twofold damaging effect. On the one hand not only is vegetation in the respective areas destroyed, but the animal population also dies out and consequently, man cannot live any more in the affected zones. On the other hand, due to the unpredictable long-term effects nobody, not even the victor, who might possibly want to settle in the conquered areas, is safe any more.

It is probable that precisely this mechanism of long-term retroactive effects, which it is extremely difficult to influence, will be the most convincing argument that finally leads to positive steps towards imposing a ban on chemical and biological weapons.

Genetic Defects Resulting from the Large-Scale and Repeated Use of Defoliants in South Vietnam

Nguyen trinh Co and Nguyen xuan Huyen, DRV

At the International Scientists' Conference on US Chemical Warfare in Vietnam, which was held in Orsay in December 1970, the DRV delegation dealt in particular with the adverse effects of the large-scale use of herbicides and defoliants on the ecology of South Vietnam and on civilians.[1] We had drawn the attention to the birth malformations and to the high percentage of chromosome fractures observed in victims.

> *„The scale of human losses and all the various forms of damage to nature, make it possible to conclude that one is faced both with genocide and biocide." (Resolution of the Conference)*[2]

The scientists who attended that conference had called for "the immediate cessation of the use of these chemical agents in the warfare", and had demanded "that the United States should put an end to this war and withdraw unconditionally all their troops from Vietnam, Laos and Cambodia" (Resolution of the Conference).

In view of this appeal and of the world-wide protests against the use of defoliants and other toxic agents, R. Ziegler, White House Press Secretary, saw himself compelled to declare on December 26, 1970, that the American government had started immediately and gradually to limit the use of herbicides in South Vietnam and hoped to complete this process by next spring. During this period of limiting the application of chemical agents, their use would be confined to the surroundings of gun areas and other US Army bases and to remote, uninhabited areas (AP and UPI).

However, since there are hardly any places in South Vietnam with the exception of remote areas without American military bases or puppet troops under American command, the US troops are continuing to employ chemical weapons despite Nixon's mock order.

In fact, American aircraft repeatedly sprayed toxic chemicals over the provinces of Ca Mau and Rach Gia in January and March 1971. On March 25, 1971, they contaminated the Tuy Hoa (Phén Yén) region, in March 1971 the Phén My (Binh Dinh) region and from April 20 to 27, 1971 the Hoa Vang (Quang dà) region. During the first six months of 1971, American troops applied chemical weapons nineteen times over the eastern part of the Thu'a Thiên region in order to destroy vital food crops.

The same applies in regard to poisonous gases: during the first six months of 1971, American troops continued to employ CS agents in several areas of South Vietnam, above all in the north of Quang Tri, Thua Thién, Quang Nam, Bin Dinh, Darlac, Tây Nguyên, Tây Ninh, Ba Ria and An Giang. CS agents are used in particular in attacks against underground shelters for the civilian population: on March 17, 1971, in Dông Kiên, Phû My (Binh Dinh), on March 6, 1971, in Hoai An (Binh Binh), on May 29, and June 2, 1971 in Ba Rang, Huong Tra (Thua Thiên).

Millions of acres of forest and cultivated land have been destroyed; the ecology of South Vietnam is being ruined increasingly; is worst of all the fact that our South Vietnamese fellow-countrymen are confronted with dangers serious to the present and future generations. We should like to bring to the attention of scientists the new situation in chemical warfare; The USA has not only failed to stop using defoliants, but with in the scope of the Vietnamization of the war in South Vietnam the Nixon Administration handed overto the Saigon Government a large store (1,500,000 gallons) of the herbicide "Orange", declaring that the Saigon Government could use their discretion at any time and place (Josef Kraft in "The Washington Post" 10th Oct. 1971. At the same time, the USA has trained Thai pilots in the use of these chemicals.

These two serious facts constitute another attempt by the Nixon Administration to continue chemical warfare in the framework of the Vietnamization of the war. Our Vietnamese scientists have intensified their investigations of chromosome aberrations in victims and their children. We take the liberty of submitting to you the results of the research work conducted since the last Conference of Orsay, which has not yet been concluded.

A study of chromosomes in deformed South Vietnamese children

Our investigations covered a total of 137 South Vietnamese children between 2 months and 5 years who had been evacuated, together with their parents, to the North and admitted to hospitals and care centres in Hanoi. 77 out of these 137 children were born in chemically polluted areas and 60 outside these areas. We found 8 deformities in the 1st and 3 deformities in the 2nd group.

We examined all these deformed children according to Lejeune's microtechnique for the purpose of detecting chromosome fractures. These chromosome tests were carried out in the hematologic-cytogenetic central laboratory of the Bach Mai Hospital under the direction of Dr. Bạch quoc Tuyên.

These are the results:

1 – Group I (A)/: Deformed children of mothers who had lived during pregnancy in areas contaminated by chemicals

Consec. No.	*No. of cases*	*Surname, name*	*Observed clin. deformities*	*No. of cells examined*	*Percentage of chromosome fract*	
1	14	Tr. du'c T...	Dextrocardia	300	0	
2	109	Ng. thanh V...	Syndactylia	Culture	Unsuccessful	
3	70	Ng. tân D...	Atrophia optica retrobulbaris	300	1	0.05
4	78	Trân thi M...	Neonatal cerebropathy	235	0.42	0.05
5	30	Ng. thi Q...	Clitoris hypertrophy	Culture	Unsuccessful	
6	80	Hoang thi H...	Multiple** deformities	300	3.33	0.01
7	84	Hoang thi Thu th...	Trisomic 21	300	3.33	0.01
8	81	Ng. thi Th...	Trisomic 21 + microcephaly*	300	3.33	0.01

* Cases presented at the Orsay Conference of December 1970

2 – Group II (A): Deformed children of mothers who had lived during pregnancy outside areas contaminated by chemicals

Consec. No.	*No. of cases*	*Surname, name*	*Observed clin. deformities*	*No. of cells examined*	*Percentage of chromosome fractures*
1	-61	Ho than Tr...	Excavation of palatine cavity	300	0
2	82	Ho V...	Adhesion of the tongue to the floor of the mouth	300	0
3	119	Ng. thu H...	Defect of the ventricular septum	300	0

Note: We found:
- in Group I (A): chromosome fractures in 5 out of 6 deformed children in which the leucocyte culture had been successful;
- in Group II (A): no chromosome fractures in the 3 deformed children.

Chromosome fractures were observed also in non-deformed South Vietnamese children whose mothers had been exposed to chemical agents.

A study of chromosomes in non-deformed South Vietnamese children whose mothers had come into contact with chemical agents

These children were divided into two groups:

- Group I (B): children of mothers who had been in areas contaminated by chemicals during pregnancy
- Group II (B): children of mothers who had become pregnant after they had left the area contaminated by chemicals

These are the results of the chromosome tests:

Consec. No.	*No. of cases*	*Surname, name*	*No. of cells examined*	*Percentage of chromosome fractures*	*P*
1	7	Tran thi C...	264	0	
2	49	Hoan di A...	200	1	0.05
3	57	Ng. công Ph...	300	1.33	0.05
4	11	Ng. minh H...	200	0	
5	69	Lê xuan Th...	180	0	
6	72	A. L...	298	0.67	0.05
7	63	Trân hurong G...	300	1	0.05
8	34	Bui thanh B...	240	0.83	0.05
9	94	Ng. van S...	150	0	
10	94	Ng. van T...	281	0	
2–Groupe 2 (B)					
1	7	Tran ngoc V...	250	1.6	0.01
2	49	Hoang phuong N...	300	0.33	0.05
3	11	Nguyen thu H...	300	1.66	0.05
4	63	Trân thanh H...	300	0	
5	66	Nguyen thi Nh...	300	0	
6	66	Nguyen thanh Nh...			

Note:

1. In both groups we established chromosome fractures in half (5/10 in group I/B and 3/6 in group II/B) of the children whose mothers had lived prior to or during pregnancy in areas contaminated by chemicals.
2. A small percentage of chromosome fractures or none at all were found in a control group.
   We did not find any chromosome fractures in the 1,700 cells examined from 3 children and 4 adults from South Vietnam who had not lived in areas contamined by chemicals. In the 2,920 cells examined from 10 North Vietnamese children (without genetic defects) we found only a very small percentage of chromosome fractures (0.068 per cent, P 0.05).
3. We agree with Legator that today approximately 1 per cent of all normal births show chromosome anomalies[3]; nevertheless, the above percentage of South Vietnamese children with chromosome fractures, whose mothers had lived in areas contaminated chemicals, seems too high to us.

4. The same structural chromosome aberrations can be identified also mothers and adults who had been exposed to toxic chemical in the 7,496 cells tested from 28 mothers and adults who had been exposed to toxic chemical we found 0,695 per cent chromosome fractures ($P < 0.01$)
5. When summing up all results of the chromosome studies conducted so far on victims of chemical contamination, we can state a total of 59 victims (children and adults) including 27.7 per cent with chromosome fractures ($P > 0.01$ – $P < 0.05$).

These results of our latest research work substantiate the view which we expressed at the Orsay Conference in December 1970, on chromosome aberrations caused by large-scale and repeated exposures to defoliants.

At the same time, scientists interested in this question, especially in the USA, are endeavouring to obtain detailed information on this war or to study its consequences . . .[3, 4, 5]

On the basis of these studies and the results of our latest investigations we consider justified to classify defoliants as MCT agents and to perform cytogenetic tests along with the other tests suggested by Legator (4) for examining the toxicology of this chemical product.

This serves to demonstrate the serious delayed effects of the chemical warfare waged by the USA against our fellow-countrymen in South Vietnam. In view of the serious threats facing our people in South Vietnam, we appeal to all scientific organizations throughout the world and particularly to the scientists participating in this Conference to intensify their efforts to induce the Nixon administration to put an immediate and complete stop to this poison warfare, unconditionally to withdraw all US troops from South Vietnam and to desist from supporting the Van Thieu Government. Furthermore, we appeal to you to investigate thoroughly together with us the delayed effects of this large-scale and continuous contamination by defoliants, and to help us find effective means to combat its consequences.

Bibliography:

[1] Vietnamese studies: chemical warfare No. 29, 1971, pp. 47 and 57.

[2] id., p. 113.

[3] Martin S. Legator, „Deficiencies in our present protocol for chemical evaluation and possible remedies" (Annals of the New York Academy of Sciences, Vol. 179, July, 6, 1971.)

[4] Nguyên. P. bun Hôi, Do-phuoe-Hiên, Germain Saint Ruf, and Jacqueline Servoin Sidoine, „Canceromimetic properties of 2,3,7,8, tetrachlorodibenzo-p-dioxin", C.R. Acad. Sc. Paris, Vol. 272, pp. 1447–1450 (March 8, 1971).

[5] Herbicide Assessment Commission (HAC) for the American Association for the Advancement of Science (AAAS). Background material relevant to presentations at the 1970 Annual meeting of the AAAS: Part 4 Herbicide toxicology: still births and birth defects.

Let Us Prevent the Use of Chemical Weapons

K. Dimov, Bulgaria

(After a brief outline of the development and use of chemical weapons since the First World War, this contribution deals with recent researches in this field after 1945.)

Thanks to the advances made in the fields of science related to chemistry, especially in biochemistry, it was possible to discover the mechanism of interaction between toxins and biosubstrates of the organism. It was found that some toxins act on the enzyme systems of the organism.

This realization became the basis for synthesising new toxins and finally resulted in the synthesis of inhibitors. Even minute quantities of such substance in an organism suffice to cause disturbances in certain metabolic processes resulting in a massive toxic effect. This group includes a number of inhibitors developed during this period and producing strong toxic effects as, for example, monofluoroacetic acid, fluoroethanol, fluoroethylamine and many others. They disturb the normal course of carbohydrate metabolism by blocking certain enzymes in the organism. The synthesis of numerous chemical compounds producing neuroparalysis on the basis of organo-phosphorous compounds including Tabun, Soman, Sarin and similar substances, was an important phase in the development of new toxins. The socalled V agents have an even stronger effect than the substances already mentioned above.

Research into metabolism of the central nervous system opens up new possibilities for developing toxins with physiological effects. The search for metabolyte substitutes led to the discovery of substances that cause serious psychic disturbances when present even in minute quantities in the air (thousandth mg/litre air). A new group of chemical warfare agents known as pschochemicals have been developed on the basis of these substances.

At present, considerable significance is attached to natural toxins produced by plants, fungi, fish, snakes, microbes, etc., as chemical warfare agents. They include the alkaloids (strychnine, eserine, etc.), the glucoside (digitalis, strophanthin, etc.), curare—the poison used by some South American Indians—, diphtheria toxin, etc. The toxicity of some synthetic and natural poisons is shown in Table 1.

Table 1

Type of substance	*Minimum lethal dose*	*Source*
Sodium cyanide	10.0	–
Muscarine	1.0	Fungus
Soman	0.1	–
Terodotoxin	0.008	Fish
Diphtheria toxin	0.0003	–
Neprotoxin of the cobra	0.0003	–
BTX Type A	0.000,000,03	Bacillus Clostridium botulinum

The foregoing data show that natural poisons are incomparably stronger than synthetic ones. Their only disadvantage at present is that they are more difficult to obtain than synthetic toxins. The use of herbicides and defoliants is a special form of chemical warfare. These substances destroy flora, which serves as food or protects life. Herbicides or defoliants ingested by humans via the treated plants cause serious physiological disturbances which sometimes lead to death. Incendiary substances are used for another type of chemical warfare. They occupy an important place in the arsenals of numerous armies and play a particularly important role in the American armed forces. Mixtures on the basis of mineral oil products, metallized incendiary mixtures and incendiary substances on the basis of thermit and white phosphorus are employed. Napalm, which was used by the USA in the Korean War and is now used in South Vietnam, belongs to the second group. Napalm was also used by Israel in the war against the Arab peoples.

American war experts are of the opinion that incendiary substances are very effective weapons for taking fortifications, and for destroying buildings and installations as well as crops and flora in general. The German cities of Dresden, Hamburg and Kassel were destroyed almost entirely in the Second World War by incendiary bombs.

Some 7,000 out of 73,000 buildings in Pyongyang were destroyed by napalm bombs in only two months during the last year of the Korean War (1950–1953). From what I have just said it is clear that incendiary substances also belong to weapons of mass destruction. According to eye witness reports, victims of napalm are a horrifying sight. Napalm sticks to the skin with such force that it can only be removed by cutting it off along with the underlying flesh. The burning victim does not lose consciousness immediately. He falls on his knees and stretches out his arms as though crying for help. Victims die so fast that they are frequently found in this position.

Military doctors are of the opinion that nearly 50 per cent of those who are saved from being burned immediately to death by napalm die soon afterwards.

This is due to the fact that not only skin, but also underlying tissue (tendons, nerves, muscles and even bones) are charred. It is obvious that these barbaric weapons, and particularly napalm bombs, kill not only those taking direct part in hostilities, but also just as many from the peaceful population, including women, children and the elderly.

The struggle waged by peace-loving people against chemical warfare has a long history. Even in ancient Rome, lawyers demanded that wars should be fought with weapons and not poisons. The Declaration of the European States published in Petersburg in 1866 condemned the use of poisons for military purposes. In 1899, a resolution was adopted at the Hague Conference, which was also attended by the US, providing for the limited use of chemical substances for military purposes, and by this they meant only those chemical substances that did not cause death. In 1907 all states, with the exception of the USA, signed the Hague Convention on the complete prohibition of the use of chemical warfare agents. This question was discussed after the First World War at conferences in Washington and Genoa and in 1925 a protocol on the prohibition of chemical and biochemical weapons was drafted in Geneva. The protocol was signed by all states except the USA, Japan and four South American states.

The nations that condemn war preparations and actively try to preserve peace call on humanity to do away with chemical weapons. In 1966, the United Nations General Assembly called on all states to act in strict compliance with the protocol of 1925 prohibiting chemical and biological weapons and condemned all acts which violated the protocol.

It is the prime duty of all those who love peace, life and people to conduct a persistent struggle for strict compliance with the humanitarian resolutions laid down in the Geneva Protocol. Those who are working on the development of chemical warfare agents, i.e., scientists, chemists and biochemists, have a particularly important responsibility as regards compliance with the clauses of the Protocol. They are the ones on whom it largely depends whether chemical weapons exist or not and whether they are used for the purpose intended. In the name of humanity and to live up to the trust of the peace-loving peoples, we must fulfil our obligations to the very end by actively opposing the development and use of chemical weapons!

Current Developments and Dangers of Atomic Armaments

B. T. Feld, USA

In the beginning the author dealt with the prospects of a Soviet–US agreement on the limitation of anti-ballistic missiles (ABM) systems and on some measures of limiting offensive ballistic missiles systems, which could be expected from the envisaged visit of the US President Nixon in Moscow. He pointed out that any such limitation would include neither so-called tactical nuclear weapons, both land-based and carrier-based, nor long-range or short-range bombers.

First, it is necessary to note that, already, the willingness to include both defensive and offensive missiles in a single package represents a significant compromise by both sides from their original positions; at the same time, the agreement to limit this package to ABM's, ICBM's (and possibly SLBM's) only, represents a further indication of willingness towards accomodation.

Furthermore, the SALT negotiations must be considered in the context of the other international movements towards arms control and détente: in particular, progress at the Continuing Committee on Disarmament (CCD) in Geneva has been substantial in the last few years–the 1970 Ban on the Emplacement of Weapons of Mass Destruction in the Seabeds, the Ban on the Production and Stockpiling of Biological (Bacteriological) Agents and Toxins of 1971. Taken together with recent progress towards agreement on systems of verification for the Treaty on the Non-Proliferation of Nuclear Weapons, this indicates a forward momentum and an improving atmosphere for arms control and disarmament which is more favourable than at any other time in the past decade.

In this regard, we should mention further collateral measures, still pending, whose rapid achievement would give further impetus to favourable developments in the disarmament field:

First, there is the extension of the partial Nuclear Test Ban of 1963 (which now includes testing in the atmosphere, in space, and in the oceans) to prohibit underground nuclear testing as well; all recent reviews of the state of seismological technology and other relevant verification techniques lead to the conclusion that an underground test ban can now be adequately verified by national means only; hence, there is no longer any reason for failure to act on this, perhaps the outstanding piece of unfinished business on the agenda of the CCD.

Second is the question of universal acceptance of the Nuclear Non-Proliferation Treaty, which still remains unratified by a number of the technologically most advanced nations.

(The author also stressed the necessity of disarmament in the field of tactical atomic weapons in Europe.)

However–to return to the developments and dangers of atomic weapons–having already noted the hopeful developments in the current situation, we must also point out some dangerous aspects of the current trends. These dangers stem mainly from the dynamics of the arms race–from the fact that, even as the major powers negotiate to restrain the growth of their atomic armaments, technological changes and new deployments (most of which were put in motion sometime earlier) are threatening to upset the very balance that the negotiations are trying to maintain and to stabilize. The technological developments that are most dangerous include the introduction of multiple independently targetable reentry vehicles (MIRV) into existing American missiles and the very rapid growth of the Russian missile force, especially the gigantic (25 megaton-carrying) SS-9 missiles.

In the past, development of MIRV was justified by some American military strategists as necessary to guarantee the American second strike retaliatory capability in the face of Russian ABM deployment. With an imminent ABM limitation in prospect, and the need for MIRV thereby removed, one might suppose that a MIRV ban, or at least limitation, would come under serious consideration at the SALT. However, on the one hand, American MIRV deployment is already so far under way that it would require a major reversal of current arms policy to agree to its elimination. On the other hand, since sufficient American testing of MIRV has already taken place to permit deployment, in both land-based and submarine-based missiles, it would be very difficult to verify compliance with a MIRV-ban, without resort to a very intrusive form of on-site inspection–a form that would probably be unacceptable to both sides...

It should be noted that the danger of MIRV is that it would, if the individual independent warheads were to become accurate enough, threaten that one side could eliminate all the other side's missiles in a first strike involving only a fraction of its own missile force. Thus, the specter of MIRV, coupled with high accuracy guidance, presents a very serious threat to the retaliatory capability of the other side. Even though the requisite guidance accuracy is probably not yet available to either side, its achievement can be foreseen on the basis of currently available technology. It is this prospect that gives rise to the grave misgivings felt by many scientists towards an agreement limiting strategic nuclear missiles that would fail to include any limitation on MIRV deployment.

It should be noted that many arms control advocates believe that a meaningful MIRV limitation is still possible–without demanding verification by on-site inspection–by way of a strict limitation on the number (and possibly types) of missile test launchings, including the occasional launchings required to maintain confidence in systems already deployed. The usefulness of such a limitation stems from the need of military planners for thorough testing of new systems before they would be willing to rely on them in an extensive deployment. Hence, such a testing limitation, even though it could not provide any guarantee against the deployment of new and destabilizing systems, would introduce a sufficiently strong slowdown and inhibition of new technological developments into the arms race so as to buy the time required by the SALT negotiations in order to devise appropriate means of bringing this race to an end...

The critical nature of the current situation, and the critical way in which it depends on technological aspects of nuclear armaments developments, places a special burden on the scientific communities. We carry a special obligation, not only to explain to our political leaders the factors in the current state of nuclear technology that make the present situation such a critical one–and at the same time present such a great opportunity for ending the arms race–but we carry an added burden of refuting the falacious and short-sighted arguments of the military and civilian cold warriors on both sides. In addition, we have the obligation to enlist, in our mutual struggle for an agreement to end the nuclear arms race, the widest segments of public opinion in our own countries and in others.

The campaign to end the nuclear arms race must be based on facts and on a mutual realization of the complex problems involved–on the truth rather than on slogans. We need as many of the facts as we can obtain, relating to the state of nuclear armaments on both sides... In this regard, the world scientific community should acknowledge its indebtedness to the Institute for Strategic Studies (ISS) of London, and to the Stockholm International Peace Research Institute (SIPRI), for the unbiased and accurate reports they have succeeded in assembling and publishing on the status of the accumulation of various forms of armaments. Without reliable data–which is also recognized as such by all the parties–it would not be possible to mount the public campaigns that are essential if we are to succeed in putting an end to the threat of nuclear disaster.

I have concentrated in the preceeding on the short-term dangers of the nuclear arms race, and on the short-term measures needed to avoid these dangers. I would like to conclude with brief consideration of a few of the longer-range problems, to which we must start now to devote attention if we are to be able to solve them before they become acute.

First, there is the problem of horizontal proliferation. This applies to those nations that, while capable of independent production of nuclear weapons, have not yet chosen to do so. Here the problem, as alluded to earlier, is to make it as attractive as possible for all countries that have not yet ratified the Nuclear Non-Proliferation Treaty to do so, and for these countries that have already ratified it to continue to adhere to it.

Then there is the problem of vertical proliferation–growth of weapons technology among the nations that have already tested (and are now manufacturing and stockpiling) nuclear weapons. These are, in addition to the U.S.S.R. and the U.S.A., the U.K., France and the People's Republic of China. Of these, neither

France nor the PRC is now involved in any of the arms control negotiations, neither in the CCD nor in SALT. It is, of course, absolutely essential that both be brought in as soon as possible. However, this is not yet an acute problem as far as SALT is concerned, since neither France nor China is yet near the stage of competition with the two main nuclear powers, nor is either showing any inclination to use its nuclear capability as a threat to other nations.

Nevertheless, the admission of China to the United Nations means that she shall soon start to be heard in the various organs of the UN, including the CCD. (Hopefully, France too will soon resume her rightful place.) There is also a good chance that, rather soon, all interested nations shall be participating in a world-wide Conference on Disarmament. Under these circumstances, it is exceedingly important that the two so-called "superpowers" put their nuclear house in order and, in so doing, devise a system of atomic controls and restraints that could easily and willingly be joined by the other nuclear powers at an early date.

Finally, it may be useful to consider a few of the currently evident, longer-term trends in nuclear weapons technology, and to speculate briefly on their possible effects on the stability of any agreements that might be reached at SALT in 1971–72. For reasons previously discussed, I assume that we shall soon have an agreement, limiting ABM's and the total number of fixed, landbased ICBM's but without any effective limitation on the deployment of MIRV's or on the improvement in the accuracy of ICBM's. Under these conditions, it is clear that fixed, land-based ICBM's will soon become vulnerable to a first strike from the other side–since the ability to destroy one missile with a single warhead, together with the deployment of multiple independently-targetable warheads, will make it possible for either side completely to destroy the missile silos of the other in a surprise attack using only a fraction of the attacker's missiles.

However, this situation is not nearly as ominous as it appears at first glance, because both the U.S. and the U.S.S.R. are already placing primary reliance, for the purpose of deterrence, on their nuclear submarines. These cannot be eliminated by the type of attack envisaged above–nor, indeed, by any means now within sight.

As a matter of fact, the existence of the SLBM systems could enable both sides to use to advantage the technological changes that will render fixed ICBM's vulnerable: If they become vulnerable, they will have lost their usefulness and it should be possible to arrive at an agreement, perhaps in the next stage of SALT, to eliminate these systems, substantially for all together, which would amount to a very considerable degree of nuclear disarmament.

However, there would be no long-term profit if such an agreement represented a shifting of the technological arms race from land-based to sea-based missile systems. Hence, it would be to the decided advantage of both the Soviet Union and the United States to start to move, already now, in the direction of agreements that would limit the growth of SLBM systems and, at the same time, try to assure their continued invulnerability. Such agreements would combine ceilings on the numbers (and perhaps types) of submarines deployed with effective limitations on the possible deployment of anti-submarine warfare (ASW) devices in the oceans.

What I have tried to emphasize in the preceeding is the very great complexity of the technology of atomic armaments, together with the need to take this technology into account in devising measures for bringing the race in nuclear armaments under control. In spite of encouraging progress, both in the SALT and the CCD negotiations, the need continues–if anything, it is increasing–for the world scientific community to take the lead in devising control measures and in developing irresistable world pressures for an end to this arms race and for the world-wide elimination of nuclear weapons.

The Danger from Nuclear Radiation to Genetic Structure

G. Fuchs, Austria

The introduction of ionizing rays in warfare has brought about a qualitative change in the effect of arms. Ionizing rays are a form of energy that sets off quantum processes in human cells and tissue which interfere with the molecular and atomic structure of living matter. The explosion of an atom bomb releases both gamma and neutron radiation . . .

Unlike conventional weapons, which use mechanical or thermic processes to destroy life completely, radiological "hits" may allow affected cells to live on under different circumstances. Molecular biology now shows us that DNA molecules, the substrate of the genetic structure of cells, use a certain sequence of the bases adenine, cytosine, guanine and thymine to keep up their identity. Any change in this sequence leads to a sudden change of genetic information or the genetic code. If body cells other than germ-cells are affected by such processes, somatic mutations occur, the gravest of which is canceration.

If this happens to a germ-cell the result is germinal mutation, which is very likely to be a negative one. Gravest of all are lethal mutations or lethal factors; next in seriousness mutations and, finally, there are the comparatively insignificant genetic changes. Radiation from nuclear arms can bring about somatic and genetic mutations, a characteristic that conventional arms do not have and cannot be expected to have. However, chemical warfare agents, such as nitrogen lewisite and its derivatives, are also likely to have similar effects.

It was not long after the nuclear raids on Hiroshima and Nagasaki that these processes actually occurred. The first malign disease to follow exposure to the rays released in those raids occurred as early as 1945. A 19-year-old Japanese youth, who was employed at a munitions factory in Nagasaki not more than 1,000 yards from the hypocentre of the explosion, lost his hair after about three weeks. This symptom prompts us to assume that he had been exposed to a dose of at least 400 r. He died of leukaemia three months and eight days after the explosion. It is not known why his latency period was so much shorter than in other cases of radiogenic leukaemia; this was, however, merely the first of a long succession of leukaemic deaths . . .

Whereas there was comparatively early general agreement concerning radiogenic leukaemia among the population of Hiroshima and Nagasaki exposed to radiation for several years there were fierce controversies about the root cause of the increase in carcinomas and sarcomas. These were partly due to the long latency periods of tumours, which did not make early statistical examinations and subsequent conclusions possible partly due to the difficulties that any such major collection of statistical data runs up against. Investigations have, however, been made over the last few years which produced evidence of an increase in malign neoplasms among survivors of the atom bomb explosion. Since the latency periods of radiogenic neoplasms are, on an average, much longer than those of leukaemia, it took much longer to verify the incidence of the former.

It is to the Japanese doctors T. Harada and M. Ishida that we owe the most accurate analysis of the incidence of tumours among the irradiated population of Hiroshima. They analyzed the neoplasms found among the town's population which were documented in the Hiroshima Tumor Register. This Register lists all malign and benign tumours appearing between May 1957 and December 1958. The Register considers all those as having been exposed to radiation who, at the time of the explosion, were not further than 1,500 m (a little under a mile, the translator) from its hypocentre. These persons are thought to have received at least 95 r of gamma radiation and 15 to 20 r of neutron radiation. Some of these persons had suffered additional internal radiation caused by the penetration of radioactive nuclides.

Comparison between the actual incidence of tumours among the exposed population and expected incidence

	Actual	*Expected*	*Found-Expected Ratio*
Carcinoma of the stomach	24	12.41	1.93
Pulmonary carcinomas	10	2.39	4.31
Masto carcinomas	5	2.49	2.00
Carcinomas of the uterus	8	4.99	1.60
Ovarian tumours	4	1.01	3.96

This table compares the incidence of tumours among the exposed population with the figures expected; the latter are based on the incidence of tumours among the rest of the Japanese population. As you can see, the figures for carcinomas of the stomach and masto carcinomas doubled and those for pulmonary and malign ovarian tumours even guadrupled.

In addition to these findings, N. Kusano and K. Sakuma reported a few years later on those tumours treated at the Hiroshima A-Bomb Hospital between 1956 and 1964. Their incidence, it turned out, was related to the patient's distance from the hypocentre and, consequently, to the amount of radiation he had received. Incidentally, tumours were also found in those who returned to the city in the first few days after the bomb was dropped; they had no doubt been exposed to neutron-induced radioactivity and radioactive fall-out.

There can be just as little doubt about the cause of these malign radiogenic diseases as there can be about the genetic radiation damage among the survivors of the atom blast. Years of efforts and piles of statistics were, however, required to prove that there was genetic damage. Geneticists started from the assumption that recessively transmissible lethal factors, which are induced by radiation in the X-chromosome, are bound to lead to the destruction of male cygotes whereas female cygotes should survive on account of their having two X-chromosomes. The two American researchers Shull and Neel said that this process must of necessity change the proportion of boys and girls born to the disadvantage of the boys In their monograph „Changing Perspectives on the Genetic Effects of Radiation", the two scientists said that this change can positively established and that this was the final proof of genetic damage. This conclusion is of particular importance since lethal mutation is the gravest type of genetic damage. Now that this has been proved, there can no longer be any doubt that less serious genetic damage may also occur, which, in human terms, is graver since such damage does not lead to the death of the foetus but to the birth of living children afflicted with hereditary disease. Thus the radiation from the atom bomb blast affects the health of the still unborn, of coming generations. One has to bear this fact well in mind to understand how nuclear arms threaten the biological foundations of human life and thus add a new dimension to war.

The two bombs dropped on Hiroshima and Nagasaki were, by present standards, so-called "small" atom bombs. The modern megaton bomb, however, is over a thousand times more powerful than the Hiroshima bomb. And there are many thousands of such bombs available, ready to be dropped. Militarists and enemies of peace try to play down and minimize the effect of nuclear arms. One only has to look at the illustrations of their underground shelters: they are several yards underground, although it is well-known that a 20 megaton bomb blasts a 300-foot deep crater in the ground, thus making all these structures useless. Other publications advertize anti-radiation drugs although everybody knows that whereas these have a limited effect if taken before exposure, they have no effect whatsoever if taken after it.

We scientists must spread the truth about the effects of nuclear arms and counter the attempts to play them down. Neither vegetating in underground caves nor taking pills can save Mankind from a world-wide nuclear war. The only proper path is that of understanding among peoples, limiting senseless armament and, finally, general disarmament!

Problems of Biological (Genetic) Manipulation of Man

E. Geissler, GDR

The concept of manipulation. This concept is used in a variety of ways at least in the German language: "Manipulation, used in its original and nowadays prevailing sense means the handling and control of man and his germ cells as a means fur Utopian 'scientific', social or political goals, which are alien to him" (Wagner 1969). Biologists, on the other hand, prefer to employ it as a neutral term, because the purposive intervention into biological (genetic) structures and functions is frequently contemplated by science with a view to improving man's lot (e. g. for therapeutic purposes), and for other reasons...

In principle, *biological manipulation* of the human being is possible on all levels, from the molecular up to the psychic. Even today, man is being manipulated through the substitution of artificial limbs for his own, organ transplantation, vaccination, administration of hormones, psychopharmaceuticals and other drugs, narcotics etc. (some of which are teratogenic, cancerogenic or mutagenic).

The possibility of *genetic manipulation*[1] is the main focus of interest in this field. One of the reasons for this is that by means of it man is able for the first time to alter, in some cases irreversibly, the very molecular foundations of human existence. For this reason this contribution is restricted to dealing with genetic manipulation.

Methods of genetic manipulation. Nowadays, a more or less directed genetic manipulation can already be exerted on microorganisms (by transduction, conversion, F-duction and transformation). Some analogous processes can probably also be used for human and animal cells at least in vitro.

1. *Hybridization by cell fusion.* Genetic defects in mammalian cells cultivated in vitro can be corrected (and probably successfully (re)implanted) by intraspecific and interspecific cell fusion as well as with the aid of appropriate methods of selecting suitable hybrid cells. It has been possible, for instance, to "cure" mouse cells that were unable to synthetize the enzyme inosinic acid pyrophosphorylase (which corresponds to the lesch-Nyhan syndrome in man) by fusing them with chicken cells (Schwartz et al. 1971). Similar fusions have been carried out with mouse and hamster cells and with frog and mouse

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[1] The term "genetic engineering" is frequently used for genetic manipulation. This term is not very appropriate; Davis (1970) has suggested that it should be replaced by "genetic intervention".

cells. At present work is in progress on the transmission of specific factors from chicken cells to human cells and on the in vitro treatment of mutant mice (*New Scientist* 1971.)

2. *Transformation.* Transformation is the transfer of individual hereditary factors by isolated DNA. Several working groups have reported having successfully transformed mammalian cells in vitro, the most recent reports coming from Ottolenghi-Nightingale (1969), Roosa and Bailey (1970) and Borenfreund *et al.* (1970). But none of the results have been reproduced by another group. There is no doubt that considerable difficulties will have to be overcome before animal and human cells can be successfully transformed.
3. *Transduction.* Transduction is the transfer of genetic material by viruses, which has up to now been observed only with bacteria. From the biochemical point of view, mammalian cells can also be transducted in vitro: certain DNA viruses form so called pseudovirions. They are similar to transducing viruses in that instead of virus DNA they contain a high molecular weight of DNA from the host cell, which is introduced into the nuclei of infected donee cells and then released there (Grady et al. 1970). Genetic activity of donor DNA transducted in this way has not been confirmed yet–probably for technical reasons. Transduction is not any more promising than cell fusion for purposes of directed gene transfer (since it is hardly likely that methods of selecting pseudovirions with specific donor genes will be available in the forseeable future).
4. *Conversion.* The development of characteristics by virus-infected cells or organisms, which are coded by the virus is called conversion. Individuals who have come in contact with Shope papilloma virus (in some instances even many years ago) can produce virus-specific arginase (Rogers 1966). Attempts have been made–unsuccessful to date perhaps for technical reasons–to induce arginase activity (Terheggen 1971) in two hyperargininaemia patients (Terheggen et al. 1970) by injecting Shope papilloma virus.
5. *Directed mutagenesis.* Numerous mutagens known to the genetics exert a mutagenic effect also on mammalian cells, at least when used in vitro. No exactly controlled mutations can be induced even in microorganisms. Scientists are considering effecting controlled mutations by coupling mutagens with certain proteins (e. g. repressors) which recognise specific DNA segments. But there are no findings which confirm this even for microbes.
6. *Antimutagenesis.* Studies aimed at making use of antimutagenic effects (e. g. Bach and Johnson 1969: Gebhard 1969) in vivo observed in mammalian cells in vitro for the protection of human genotype–particularly in those exposed to mutagenic dangers–are of special importance in view of the increasing pollution of our environment by (potentially) matagenic noxae. It is entirely unclear as yet whether this will be possible.
7. *Cloning.* Cloning–cultivation of organs or organisms from individual body cells–is often mentioned in discussions in connection with genetic manipulation. It is possible, for instance, to clone frogs by transplanting nuclei from

intestinal cells or from other specialized cells to denucleated ova. But no analogous results have as yet been achieved with mammals. Moreover, in the case of plants it is possible to differentiate individual cells and their progeny as complete plants. At least some authors assume that this should also be possible with mammalian cells after 1990 (Moore and Glick 1967), but this too is sheer speculation. Despite this, at least authoritative molecular genetics engineers regard cloning as the first method which will make it possible to manipulate mammals genetically.

8. *Phenotypic effects.* If the occasion arises it will be possible to effect a "phenotypic transformation" and consequently a brief, reversible manipulation by introducing messenger RNA. Plans are being discussed to induce certain genes (of the genome, which for the most part is present in a repressed state) or to repress active genes in order to control certain synthesis functions (e. g. in substitute organs) in a reversible manner.

The usefulness of genetic manipulation

> *"It is now conceivable that... within the next five to ten years certain inborn errors of metabolism will be treated or cured by the administration of the particular gene that is lacking". (Aposhian 1970).*

This type of genetic manipulation must be given unqualified approval. The moral, ethical and juridical problems connected with such manipulation would not fundamentally differ from those associated with other forms of medical invention.

The immediate objective is to eliminate or prevent symptoms of disease (without repairing the genetic material in the germ cells). To do this, the (affected) body cells of a patient are treated either in vivo or in vitro and reimplanted. The aforementioned phenotypic effects can also be used for this purpose, e. g. for inducing certain gene products that are no longer produced at the site of synthesis. Up to now only the unsuccessful attempts made to treat hyperargininaemia by conversion have become known. The cultivation of clonal substitute organs from cells taken from the subsequent donee patient should also be mentioned in this connection as an interesting variation in overcoming the immunity barrier involved in organ transplantation.

A long-range objective is to treat symptoms of disease and at the same time repair the irregularities in the genetic material of the germ cells, which should preferably be done in vitro for reasons of efficiency and checking the measure of success. This would enable people with defective genetic material to produce offspring without passing on the genetic defects.

The methods described can presumably be used only for treating disorders caused by a single factor (e. g. sickle cell anaemia, phenyl ketonuria, haemophylia) if they can be used at all. But characteristics caused by a single factor are relatively rare in mammals. Most hereditary characteristics are controlled by several genes and probably cannot be influenced – at least not in a controlled way – by the methods mentioned in the foregoing. This also applies to genetic components of such quantitative characteristics as intelligence, temperament, build, etc.

"Positive eugenics"
Whereas genetic manipulation of the human organism with a view to controlling genetic diseases (including malignant tumours) should find our unreserved approval, attempts to "improve" human genotype, "human breeding" must be rejected on principle. Human breeding is incompatible with our present ethical and moral concepts and is out of the question as long as the problems involved have not been solved on the social plane. Apart from the object of such breeding, no unanimous opinion is to be expected regarding this question (see Mackay in Wolstenholme 1963). And finally, human breeding, as seen today, is an altogether Utopian proposition with regard to its feasibility due, among other things, to the fact that the hereditary characteristics that might be of interest are controlled by several genes...

Misuse of manipulation
Just as in any other field of science, advances made in the field of modern genetics are ambivalent in their utility. Biological weapons incorporating bacteria and viruses of high virulence and having a modified antigen content, maximum resistance to ultraviolet radiation and to antibacterial or antiviral agents, etc., represent an application of genetic discoveries that is adverse to man. The infection of a population to be attacked with a converting virus, which by itself causes no harmful effects, but which sensitizes the population to another factor, which is likewise normally harmless, is one of such possibilities (Luria in Sonneborn 1965). The sensitization of Drosophila melanogaster to carbon dioxide by a virus-like factor can be regarded as a model case in this connection.

"Human breeding"
Occasionally the fear is voiced that methods of genetic manipulation could be misused for breeding genetically programmed subjects. Wagner (1969) sees the following possibility:

> *"The governments can then select and have the required technicians, military men and workers bred on their 'human farms' by women used as broodmares for implanted eggs or by ectogenesis apparatus and then arm them for gene war in order not to be 'too late'."*

But here once again we must repeat the comment made to item 5, i.e., apart from the fact that none of the methods mentioned are feasible–and even less so on a large scale–either now or in the near future, the fact that the characteristics of the human organism that would be of major interest in biological warfare are determined by several genes poses a stumbling block. Most diseases controlled by a single factor are attended by such extensive behavioural disturbances that their application is hardly conceivable.

But cloning, if it should ever become technically feasible for mammals, could be misused to an extensive measure. This is one reason why Watson (1971) has recently suggested that experiments with human embryos should be prohibited on an international scale. Lederberg (1971) states in this connection:

> *"Cloning is the only technique by which the fantasies of the racial purists could be realized, and if Hitler had a scientific view of race, he might have promulgated the method."*

The danger of misuse of methods of genetic manipulation cannot lead to an (international) prohibition of research work in this field, apart from the fact that it would be impossible to implement such a prohibition. But there are a number of alternative possibilities for preventing misuse.

Personal engagement of scientists

> *"It is the greatest responsibility of the scientists that every single one of them really takes upon himself the moral effort required for this and then clearly takes sides, with all the consequences" (Steenbeck 1968)*

– this is already being practiced in an exemplary way by Beckwith (1971) and some other leading molecular biologists. This also presupposes active participation by scientists in the struggle to eliminate participation by scientists in the struggle to eliminate imperialist misanthropic regimes in accordance with the proposal made by Shapiro, Eron and Beckwith (1969)

> *"that scientists, together with other people, should actively work for radical political change in this country" (USA, E.G.) (comp. also Beckwith 1971).*

State measures

Constitutional prohibition of all forms of misanthropic experiments. We, GDR scientists, are proud of the fact that our Constitution contains the following provision:

> *"Any misuse of science directed against peace, international understanding, against the life and dignity of man, is prohibited" (Article 17, Section 4).*

International measures

World-wide prohibition of the development and production of biological weapons. Foundation of special committees of the United Nations (Luria, in Sonneborn 1965) and of other international bodies, which deal with all questions of genetic manipulation of man. The World Federation of Scientific Workers can play an active role in this work.

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The Present State and Future Prospects of Disarmament Negotiations

D. R. Inglis, USA

The great nuclear powers have declared general and complete disarmament (GCD) to be their ultimate goal. In Article VI of the Non-Proliferation Treaty they and others have undertaken

> *"to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament, and on a treaty on general and complete disarmament under strict and effective international control."*

The phrase "at an early date" applies only to cessation of the arms race and this puts first things first–the arms race must at least be stopped before it can be set in reverse. This is what the Strategic Arms Limitation Talks (SALT) are about.

Many thinkers have long been aware that a continued and spreading nuclear arms race with no limitation in sight makes nuclear war and catastrophic destruction of a large part of the human race and its civilization almost inevitable. To these thinkers the slow progress of SALT is discouraging...

(The author then proceeds to expound the work of the UN Disarmament Committee).

The SALT talks were proposed by the USSR in late 1968 and started in Helsinki in November, 1969, after more than a year of regrettable delay caused by the U.S. in connection with its presidential election. There have been five rounds of talks alternating between Helsinki and Vienna, the last having recessed this September and the next about to convene in Vienna on November 15, 1971. The slow pace of the negotiations is suggested by the fact that after the first year and a half a joint communiqué was issued, with considerable fanfare at least in the West, announcing somewhat vaguely that the two sides had at last agreed on the areas in which they would negotiate agreement.

It appears that one of the greatest difficulties in the first year and a half of discussion was disagreement over what constitutes strategic nuclear weapons. The long-range ICBMs designed to operate between the US and USSR homelands are clearly strategic, but apparently the US wanted to classify its weapons in Western Europe capable of reaching the USSR as tactical and conversely the USSR wanted to exclude from the strategic category its weapons capable of reaching Western Europe but not the US...

It would be gratifying if the agreement stopped ABM deployment approximately where it is could serve as a pattern for stopping all nuclear deployment where it is, but this may be too much to hope in the present SALT talks.

To help judge the prospects of the talks, it may help to identify some of the attitudes that have made arms control so elusive in the past and in what ways they may be changing. In the larger picture of international rivalries, the disarmament negotiations–both the SALT talks and the CCD–must be seen in the dismal perspective of the dynamics of the nuclear arms race.

(This is followed by statements on the "continuity of the military tradition" which led to the transfer of the striving for military predominance also to the nuclear arms potential.)

Most thinkers particularly outside military planning circles are convinced that the devastating power of the weapons is so enormous that the only really rational purpose of nuclear weapons is to prevent their use, to maintain and stabilize the posture of deterrence in a world not yet ready for far-reaching disarmament. The suddenness and enormity of the prospective havoc, with no time for gradual adjustment to calamity, and the unpredictable extent of the lingering side effects, make the expected terror so much greater than that anticipated at the outset of pre-nuclear wars that it seems unthinkable that any nation should deliberately start a nuclear war or press an advantage far enough to risk starting one. It seems this should be so even if one side has twice as many weapons and better shelters and might suffer not quite such catastrophic devastation as the other. The effectiveness of growing stockpiles follows a saturation curve.

Yet the opposite is assumed in the course of national military planning. The balance is struck in various imagined situations in intellectual exercises such as "war games" in which the initial assumption is that both sides are completely malevolent–that either will jump at an opportunity to exploit a relative weakness of the adversary in pursuit of some nationalistic goal, even if this means accepting many millions of casualties so long as this is substantially less than inflicted on the other side. It often appears that planners, having labored in imagination with these assumptions that have become grotesque in the nuclear age, project them into real life as a basis for wanting to keep on amassing nuclear weapons long after the reasonable needs of deterrence have been amply met.

In addition to this inertia in military thinking, there is also an equally serious inertia in economic decisions. Large-scale industrial enterprises acquire an inertia keeping them going sometimes beyond their period of usefulness. This comes about not only because large investment has been made in plant and equipment from which it is desired to realize the full yield, not only because management has a vested interest in prolonging a favorable economic position, but also very largely because a large number of workers have ordered their lives around a particular activity and there is a political reluctance to disrupt their lives by stopping production and forcing them into an uncertain adjustment to some new activity. These influences may appear in quite different light under different ideologies. In the capitalist West they appear more explicitly in terms of the profit motive, both for management and for workers. But do they also exist, perhaps in other forms, in Soviet society?[1]

In the US, these influences are felt as pressures on representatives of the people in Congress who are responsible both for appropriation of funds and for approval of arms-control treaties. To workers and others engaged in arms production this is a vital issue and they tend to support for re-election candidates who favor continued arms production. An important objective of many citizens' organizations in the US is to counteract this by getting enough other voters interested in foreign affairs and in the dangers and futility of the arms race. While this effort has not yet swung the balance, it has at times come close and has made Congress scrutinize military appropriations more carefully than before. The trend augurs well for approval of arms-control treaties.

While these military and economic attitudes are strong in fluences tending to intensify and prolong the arms race, with which one must reckon in hoping to stop it, the primary cause of the arms race has been international rivalry and distrust. In guessing about the future of arms-limiting agreements, one must look for changes in all these influences that might make agreement more easily attainable in the future than in the past...

The US had the initial advantage that its industry had emerged unscathed by World War II, and it could then take superiority (in A-bombs; the Editor) for granted. Its complacency was shattered by the early Sputnik achievements by the USSR and in reaction to this there was a spurt of tooling up and producing H-bombs and missiles in great numbers. This put the US far ahead of the USSR in numbers of H-weapons, and as late as 1968–after the US strategic stockpile had levelled off–Secretary of Defense McNamara could assure Congress that the US had three to four times as many deliverable H-bomb warheads as the USSR...

Each spurt of procurement of missiles by one side may be seen as a reaction to something the other side has done or is thought to have done. Thus, when the US forged far ahead in the early 'sixties, it was a typical reaction for the USSR to start tooling up to catch up. With the inevitable time lag, this had strong influences and led to a very rapid increase in numbers of nuclear weapons of the USSR in the late 'sixties and early 'seventies. US planners are now faced with the question how far this increase may carry and whether to respond to it in kind. At the present time, it means that we have a situation much closer to parity between the two sides than has prevailed in the past. It may be psychologically helpful that the parity is not precisely defined and each side may now claim superiority–the US in numbers of deliverable warheads and the USSR superiority in megatons. This achievement of approximate parity may be the crucial difference making the quest for arms limitation more apt to be successful now than earlier...

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[1] See Resumé of the Discussion.

(In the following it was said that observation by means of satellites reduces the extent of secrecy and makes inspections on the spot largely superfluous, except in regard to the MIRV-systems, the multiple warheads of which cannot be distinguished from single warheads at a long distance.)

The prospect that MIRVs may soon be fully developed and widely deployed poses a particular problem for arms control. The trouble with MIRVs is not that the terror of the deterrent "balance of terror" is increased, for the total power of the nuclear warheads goes down drastically, and even the area destroyed goes down somewhat, as the number of warheads per missile is increased. This means that a missile delivers more but less powerful explosions, spreading the deterrent threat out to cover smaller towns. The real trouble with MIRV is that it upsets the stability of the deterrent so far as this is dependent on fixed, land-based missiles that could be eliminated by a direct hit. It means that one missile could in principle interdict several missiles. With parity of numbers, it would then in principle be possible for one side to eliminate all the missiles of the other side in a preemptive first strike, so long as the other side adheres to the conservative doctrine of not firing when approaching missiles are first sighted. Existence of MIRVs encourages abandonment of this relatively safe doctrine and increases the danger of accidental war through mistaken signals. One answer would be to abandon land-based ICBMs and depend almost entirely on submarine-launched missiles for deterrence. A better answer would be to eliminate MIRVs by mutual agreement. The trouble is that this would apparently require on-site inspection on some sampling basis to assure compliance.

The rate at which MIRV development is being pushed at least in the US seems to be an indication that an agreement to limit MIRV is not likely to emerge soon from the present SALT talks. This in spite of the fact that the original argument for MIRVs was the supposed need to penetrate ABM defenses, and now it seems likely that there will not be large-area ABM deployment. It may be that it is considered unrealistic to seek an agreement to limit MIRV because of the anticipated usual impossibility of obtaining on-site inspection. It is here that the question arises whether the USSR might not find it to its advantage to concede on-site inspections to the very limited extent of sample inspections of some missiles at already-known locations. Now that there has been technical erosion of secrecy and the achievement of approximate parity has made secrecy much less important to the USSR as a military asset, it should not be impossible. There is also a question whether the US would concede the inspections, but it has less tradition adainst it. The advantage to both sides in stabilizing the deterrent and avoiding another round of the arms race could be quite great.

Perhaps a realistic hope is then that the result of the present or a near-future round of SALT talks will be to limit ABM deployment drastically and freeze levels of land-based ICBMs at present numbers, these being considered on their way to obsolescence anyway because of the advent of MIRV. One would like to hope for more, for at least a cut-off of all categories of nuclear weapons either at present levels or some agreed levels near these according to some formula representing approximate parity, and with MIRVs eliminated. One would also hope to restrain the qualitative aspects of the arms race, perhaps through limitation of development funds and of testing. All this could set the stage for actual reductions to follow. If the SALT talks succeed in freezing ABMs and numbers of strategic launchers this will be a very important gain even if they do not succeed in limiting MIRV development...

Twenty years ago some scientists felt strongly that arms limitation should be achieved quickly to confine deterrence to A-bombs, avoiding the horrible prospect of wide deployment of H-bombs. Almost fifteen years ago scientists from East and West started discussing these problems together and largely agreed that stopping the arms race where it then was and cutting back to lower levels was the only safe course for mankind. A perennial difficulty they met in discussing how to influence their governments was that secrecy and inspection are mutually exclusive. Ten years ago some of them solved this problem in principle by proposing a scheme whereby weapons would be eliminated in one region after another of both countries simultaneously, as inspection was introduced into those regions. Thus the amount of inspection would increase with the amount of disarmament, until an important interim stage would be reached known as the low-level stabilized deterrent. In it the two sides would have equal and relatively small numbers of missiles and means of verifying compliance, but would not have targing information that might make possible a first strike.

Since then the numbers of missiles have increased enormously but the concept of cutting back to some lower-level stabilized deterrent should remain a tenable interim goal. It might be hoped that steps in this direction would follow a cut-off negotiated at SALT. Modern satellite surveillance might make the somewhat awkward regional plan unnecessary, the details being worked out in other ways. It would probably be necessary eventually to accept China as an approximately equal participant in the low-level deterrent, either by formal negotiation or by removing the incentive for her to make the expenditure to go further, knowing that the others would resume the race if she does. A three-way equalized low-level deterrent would be safer than an open-ended race. It would have to be achieved fairly soon if it is not to require a cut-back on the part of China that might be hard to negotiate. At some level, France would also have to be considered.

Of the influences we have mentioned that oppose disarmament, the military desire for ever more weapons remains unchanged. The economic pressure to keep workers busy is increasingly compensated by growing appreciation of the economic burden of continuing the arms race and the need for more constructive uses of effort in the civilian sector. The achievement of approximate parity and the consequent reduced importance of secrecy should considerably enhance the prospects of success in the present and future talks. And the very fact that the two sides have—perhaps luckily—lived together through two decades of neclear confrontation while cooperating in many fields, if it does not lull us into complacency, may have increased our mutual respect and removed tensions and distrust sifficiently to make agreement even beyond SALT possible this time, though it is very late.

The Danger of Chemical Weapons

K. Lohs, GDR

The age of modern means of mass extermination was ushered in near Ypres on 22 April 1915 when chlorine gas was used for the first time by the imperial German troops. The development of chemical warfare agents in the First World War was characterized at first by a hectic search for poisonous substances which were suitable for large-scale use both with reference to their effect on the human organism and to the economic production process. Only after the First World War was the attempt made to systematize further research in the field of chemical warfare agents. Despite the research work done it nevertheless appeared on the eve of the Second World War that the development of agents pursued in the 1920s and 1930s did not give rise to any new knowledge. Only after the Second World War did it turn out that work on the phosphoric organic agents had been opened up and systematically expanded in Germany, in the laboratories of the then IG Farben Trust, as well as independently in Great Britain.

The very spectacular development in the field of nuclear weapons nourished the view at the end of the 1940s and beginning of the 1950s that chemical agents were only of interest for military history. This opinion was bolstered up by the fact that a large number of publications disclosed the production and testing techniques for the phosphoric acid ester agents of type Tabun, Sarin and Soman which up till then had been kept secret. But in the mid-1950s it became evident that–proceeding above all from considerations made in the USA–tactical and also strategic importance is to be attributed to chemical warfare agents even under conditions of a missile nuclear war.

In this phase of a new upsurge in military chemical and toxicological research the results obtained from purely civilian research through the work of Tammelin in Sweden became known. However carefully considered the publication of these research results might have been by the Swedish side which from the very beginning wished to remove any doubt of research serving aggressive goals, this publication had serious consequences in the following years. By the disclosure of the compounds which have become known in scientific literature as the Tammelin esters the field of highly toxic V agents, even now unsurpassed in their effectiveness, was opened up, especially in the USA and in other states of the North Atlantic Pact.

Compared with the development of V substances the other branches of development of chemical warfare agents, above all the psychochemicals, some means of sabotage, new irritants and finally the militarily important herbicides are of only second and third rate interest.

On the Present Status

The evaluation of the international scientific literature from the point of view of the civilian toxicologist permits the conclusion that among the synthetic poisons with a direct fatal effect the V agents have up to now not been surpassed, i.e. this group of phosphoric organic compounds has a central importance as offensive weapons and the physical destructive power of these chemical agents can be equated with small to medium calibre nuclear weapons. The toxicity range of these V agents lies between 0.05 and 0.01 mg/kg (LD_{50}-value[1]). Further developments in this sphere will considerably depend on how much detailed knowledge can be obtained on the enzyme structure of the chlorinesters, thus leading to improved knowledge concerning the active centres of these esters.

Along with this dominating group of V agents a few of the so-called classical stubstances have a limited significance for limited tactical operations; here we should mention above all the sulphuric mustard gas (Yperite), a substance which has been of military interest since the First World War. In tactical mixtures, for example, in combination with Sarin or Soman, it is especially suitable for the long-term poisoning of the countryside.

The ever greater involvement of the civilian population in warfare has led to considerations in the past ten years which give a certain topicality to the irritants again. In view of the fact that today such irritants as, for example, ortho-chlorobenzylmalonitrile, possess extremely effective compounds which in use against the unprotected civilian population create panic and disorganization and in view of the fact that technically it is extremely problematical to equip the entire civilian population with appropriate protective clothing, it must be assumed that an aggressor (for example during an attack on centres of industrial concentration and on big cities) will employ such substances.

Along with these irritants a subordinaté role is also played by psycho-active compounds—at least when it is a question of excluding small, but with reference to organization and leadership important groups of persons. Finally, it cannot be ignored that US aggression in Vietnam has shown how extremely destructive the herbicides originally developed for purely civilian purposes are when used in military operations.

Since today there is a broad range of biologically active compounds in the field of plant protection and pesticides, it must always be assumed that among these substances some will be selected for certain military objectives. With the destruction of crops or the mass killing of animals an aggressor can indirectly create tactical and strategic advantages for himself.

Whereas ten or fifteen years ago one was able to survey the poisons which were in question for military use and exactly characterize their most important representatives, in the last years it has become more and more difficult, in view of the breadth of scientific development in the field of biologically active compounds, to evaluate precisely the agents which can be considered for use in warfare. This means that an aggressor using chemical weapons has an additional advantage militarily speaking, since the danger growing out of military toxicological developments is to a great degree unknown and therefore it becomes more and more difficult to organize comprehensive protection against such means of mass extermination.

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[1] Dose of an agent, which is lethal against half the population exposed.

Development Trends

With certain reservations some lines of development in the field of chemical weapons can be derived from the data of the scientific literature and from the comments of military experts. A further increase in the absolute lethal dose is scarcely to be reckoned with among the phosphoric organic substances. The search for new compounds in this class of substances will probably be mainly aimed at finding V agents for which the present antidote preparations and those being developed will be insufficient, i.e. against which there is no possibility of successful therapeutic treatment. In view of this one could speak of "antidote-resistant V agents".

However, it is a safe bet that there will be a number of surprises in the next few years in the field of psychochemicals. It is obvious that the piperidylbenzylates do not signify the end of military toxicological development in this field. However, at this moment it is not possible to obtain closer details about military chemical developments in the field of psycho-poisons.

There is a very great danger that above all in conflicts which are relatively limited territorially speaking, especially in the suppression of the struggle for freedom of the Asian and African as well as Latin American peoples, terror and sabotage poisons will be employed which kill off useful plants and animals thus depriving the people of their food basis. Special military toxicological development trends for such poisons cannot be deduced, since pragmatic use will probably be made of compounds which are available in sufficient quantities in civilian production. But it should not be ruled out that substances like dioxine, a very dangerous impurity contained in the 2,4-D and 2,4,5-T preparations used by the US army in Vietnam, are used as deliberate additives which, for example, make the effects of certain herbicides even more insidious than they already are. Present techniques and methods in synthetic chemistry make it possible to set up very quickly large-scale production of dioxine and related compounds for military use.

Developments in the field of irritants are also probably going on apace. This may be assumed especially because in the course of the past decade the algogenes, that is, pain producers (or, if preferred, nerve irritants) have become an object of interest in military chemistry. The possibility of making use of chemically induced pain as a weapon of terror means that a new stage of escalation has been undoubtedly reached in the development of war agents.

Even though at the moment the known algogenes are more suitable for individual terror or putting relatively small groups of peoples out of action, it is probably only a question of time before such substances are developed so far that they—especially for use in terrorizing the unprotected civilian population —may become as equally important as the psycho-chemicals.

The synthetic peptides with their toxic character must be regarded as one of the most malefic developments in the field of military toxicology. Such synthetic toxins made up of eight to ten amino acids can already be produced in the laboratory. The rapid development of biological engineering will make it possible in just a few years to produce synthetic or partially synthetic toxins on a large scale. Such toxin agents represent a combination of the hitherto chemical and biological weapons. For this reason it is very important that a close watch be kept on all research centres working on peptides or toxins—even though at the moment they appear to be engaged in purely civilian research work.

Suspicions about the so-called "fusion poisons" are very speculative but by no means pulled completely out of thin air. These are substances which exist in two relatively unpoisonous primary stages, whose poisonous effect appears only at the moment they combine. This can take place when used in the field but can also be delayed until such time as the components enter the human organism where they combine under the catalytic influence of certain enzymes there. The great advantage of such compounds for the aggressor is that the primary stages involved require no special protective precautions, and this is very important, among other things, for storage, filling and direct military employment. The present stage of development, however, makes it impossible to give any more detailed data on this field. One can only hope that the peace-loving forces throughout the world will be able to stop in time further escalation in this field by means of a general ban on ABC weapons.

Some Special Aspects of the Dangers Caused by Chemical Weapons

When discussing the dangers arising from chemical weapons most attention is paid to the acute toxic effects of these substances, i.e. the effects which lead to immediate death or to symptoms of poisoning which occur immediately or within a short time.

It is becoming more and more clear—and not least of all as a result of the criminal employment of poison in Vietnam—that in addition to the acute toxic effects of chemical agents, the delayed and lasting injuries occuring after recovery from the poisoning are very important for assessing the danger of such agents. The first indications of such delayed action were observed in isolated cases even before the Second World War when it turned out that poisons with an alkylating effect as, for example, sulphur mustard gas, caused injuries to organs after ten or fifteen years, injuries to the liver and also nerve injuries among former soldiers and also among production workers who had to produce this substance during the First World War.

This state of affairs became even more obvious after the Second World War. Although chemical weapons had not been used, in the 1950s former workers in the production centres of the fascist Wehrmacht (who had recovered from light poisoning and the subliminal effects of small quantities of substances) –above all those with alkylating characteristics–developed hepatotoxic and psycho-pathological-neurological symptoms. In the FRG U. Spiegelberg dealt with this complex of questions in a very revealing monograph.

In the meantime more and more cases are coming to light of residual damage among workers engaged in civilian pesticide production and use, which arise as a result of paying insufficient attention to labour safety regulations or are caused by prolonged contact with compounds which have the same effects as chemical warfare agents. In recent years it could be shown that a few such compounds are able to act in an alkylating way and lead, as a result, to cancerogenic and cocancerogenic effects. Teratogenic injuries have also been noted. Such findings make it clear that the use of chemical weapons not only leads to immediate acute dangers but also causes lasting injury to the health of survivors which may have serious effects on later generations as well.

In this respect it is simply grotesque when the protection of the environment from the effects (by no means to be unerestimated) of, for example, DDT and other pesticides as well as the waste products of industry and transport, is made world problem No. 1 with a great propaganda effort and the same people who get upset about the DDT content in the body fat of penguins, approve or make available the means for a further development of chemical warfare agents and production. Naturally, the efforts now being made to protect the environment are completely legitimate and they must also be considerably intensified beyond their present scope if the generations to come are to find an environment worthy of Man. Environment protection, however, becomes a mere farce if the building of measuring and supervisory stations for industrial emissions and the equipment for decontaminating and purifying industrial and communal waste water are used as a cover for the cleverly prepared use of chemical warfare agents, and if the whole fuss about environmental protection is simply designed to divert attention from the real imperialist objectives. This state of affairs, however, shes light onto the multi-layered responsibility which is nowadays carried by those scientists working on the production and reaction behaviour of biologically active compounds. More than ever before it is now a question of supplying all men of science and technicians with a knowledge of the laws of the development of human society, so as to put them in a position where they can draw for themselves the conclusions as regards their responsibility for safeguarding peace. We scientists in the GDR are aware of our great responsibility and consider it our fundamental duty, allied with the working class, to create the necessary conditions for maintaining peace in the interest of Mankind.

In the past few years the author of this paper has expressed his point of view or made supplementary observations on this problem in the following publications:

1. Karlheinz Lohs,Synthetische Gifte, 3rd edition, Berlin, 1967.
2. K. Lohs, "Über schmerzerzeugende Substanzen (Algogene)" (On Pain-Producing Substances (Algogenes), in *Zeitschrift für Militärmedizin*, Vol. 9, No. 5 (1968), pp. 281–285.
3. K. Lohs "B- und C-Kampfmittel bedingungslos verbieten!" (Ban all B and C Weapons unconditionally!), in *spektrum*, Vol. 15, No. 11 (1969), pp. 435–437
4. K. Lohs „Gifte und Umwelt" ("Poisons and environment"), in *Zeitschrift für Chemie*, Vol. 10, No. 3 (1970), pp. 81–87.
5. K. Lohs and H. Schr. "Physikalisch-chemische und biophysikalische Faktoren der Einwirkung chemischer Kampfstoffe auf den Organismus" (Physico-chemical and Biophysical Factors of the Effect of Chemical Agents on the Organism), in *Zeitschrift für Militärmedizin*, Vol. 12, No. 1 (1971), pp. 1–5.

On the Necessity of a Modern Definition of the Term "Biological Weapon"

W. Michajlow, Poland

(The contribution was introduced by statements on the advancement of biology and on the great dangers of its misuse.)

"Classical" B weapons are made up of various agents which can be disseminated among fighting troops in their hinterland in the form of bacteria or pathogenic viruses introduced into drinking water and food or through infection. In one sense B weapons do not differ from other weapons (A and C weapons); they constitute a threat to the whole population.

Biological weapons have most probably only been used to a limited extent up to now because of their two-edged character. But a great deal of information points to the fact that further attempts are being made to improve these weapons and the "assortment" of microbiological agents extended. These attempts as well as the storage or destruction of obsolete or superfluous stocks of bacteriological weapons are highly dangerous. Thus the fact of the existence and perfection of these dangerous bacteriological weapons should not be taken lightly–they are something to be reckoned with.

One must also include those agents in the list of new biological weapons which, although possessing the character of a chemical substance, have a certain selective effect on human physiological functions. By this we do not mean murderous chemical weapons of the old type, as for example, mustard gas, but rather substances which render people incapable of fighting, cripple their will-power, cause nervous shocks or more or less lasting disturbances in physiological and psychic functions. In view of the fact that recognition of the biological action of such substances can only be effected by biologists and suitable biological examinations they are likewise counted among the biological weapons.

At a time when one of the main international concerns is man's environment such weapons cannot go unmentioned, weapons, which through misuse of biological knowledge, are able to bring about a lasting degeneration of the environment, are capable of destroying organisms in the soil and completely disturbing the balance of soil and water ecological systems. The herbicides introuduced into agriculture in the 1930s are able to destroy certain weeds in fields or–as arboricides–unwanted trees and types of undergrowth in forests. The US army has been using such agents for many years now in its war in Vietnam. The American brass-hats have mainly used four types of mixed herbicides in very large quantities to destroy standing crops and forests. As the journal Chemical and Engineering News of May 27, 1968 wrote, in 1967 US aircraft sprayed about 50 million pounds of herbicide over an area of about one million hectares of farmland in South Vietnam.

Investigations into the results of this "herbicide war" proved that the chemical substances not only destroyed the trees in the forest and the standing crops in the fields but also killed off the animals and caused lasting contamination of the soil. This led to a lasting disturbance in the ecological balance. The population in the regions sprayed with herbicides are not only threatened by starvation but also by the inability to utilize these regions agriculturally for many years.

In this way the people are caused great harm through destruction of the environment and damage is caused to the entire nation which cannot be made good. This is a particularly loathesome type of action, since precisely at the present moment large scale campaigns are being undertaken to protect the human environment. Exploiting herbicides for war purposes is also a case in which the results of biological knowledge are exploited, knowledge, which, on the other hand could bring great benefit to mankind and is of very great importance for the development of agriculture and forestry.

If we imagine the possible consequences for the future we see that then we cannot accept the dangers constituted by delayed-action biological weapons lightly. Thanks to modern genetics and molecular biology it will be possible to interfere with the human genom, man's hereditary characteristics... The future of the so-called genetic "engineer" is being spoken of more and more frequently, i. e. the possibility of intervening in the structure of the human genom by making use of various means which include various external physical and chemical (mutagenic) factors. However, in addition to constructive "genetic engineers" there can also be destructive ones. Ways can be developed of bringing about unfavourable changes, both physical and psychic, in coming generations. It is difficult to predict the forms which such "genetic weapons" might take and their consequences. One must nevertheless be conscious of the fact that in addition to direct genocide it is becoming apparent that there is at present a danger of delayed-action murder of human beings which manifests itself in degeneration of the coming human population.

If one considers that the various types of weapon mentioned above cannot be developed without the cooperation of biologists and the exploitation of biological knowledge, it makes sense to include them in the category of biological weapons. The definition of the B weapon—as a weapon whose development and application exploit the achievements of biological sciences and requires the participation of biologists—thus seems to be correct.

This matter is not only important from the point of view of examining all the knowledge we have on the danger threatening mankind. In the light of the question of scientists' social responsibility we should ostracise those who help think up and develop the various types of weapons.

No social force can hold up progress in the biological sciences—as is also true of progress in all other sciences. However, one must condemn the biologists who create the theoretical foundations for weapons which can be regarded in the broadest sense of the word as B weapons and who also develop the technology of these weapons. The responsibility of all biologists as regards the use of biological findings for criminal purposes, and the varied possibilities for making use of these findings, ought to find expression in society's information media, in a warning to society and in participation in appropriate social and political campaigns.

Potential Dangers of BW to Small and Developing Countries

S. Neytchev, Bulgaria

Debates concerning the prohibition of C and B warfare have occupied an important place in disarmament talks since 1966 and particularly in 1969 and 1970. Comprehensive surveys were prepared both by a group of experts at the request of UN General Assembly and WHO. It was generally agreed that B agents in particular are potentially unconfined in their effect both in space and time. Uncontrollable results might be expected upon human and animal health and on the balance of nature. It was emphasized that reliable verification methods do not exist and a secure defence system could not be envisaged.

The lack of a verification system however encourages research work on elaborate schemes for defence. The testing of such schemes however seems to destroy confidence concerning ultimate prohibition of BW. Furthermore, research into defence methods might eventually lead to discoveries in the aggressive counterpart of the problem. In addition some countries wish to reserve their right to produce limited quantities of bacterial and toxic materials for laboratory work and for developing protective substances.

The attitude of the small European and developed countries should not be neglected. Apparently small nations are not interested in developing BW because such policy is incompatible with their national interests...

As regards the developing countries the BW might be also used in cases of undeclared war and other hostile activities which flare up now and then. The limited number of educational, scientific and cultural institutions, unsatisfactory hygienic conditions, a poorly developed communication system, frictions of nationalities within a single state are factors which might influence a decision to use BW both as means for the solution of immediate problems or in pursuit of more remote effects. Such development becomes quite possible if the military and economic resources of a great power take part in the local conflict.

Research work as regards elaborating defence mechanisms for the small and developing countries against BW is highly complicated and demands a great number of qualified scientists and modern equipment. Most of it is guess work, the trends of development of the biological weapons being almost totally unknown.

The exploration of even minor problems requires prolonged activities of a well trained staff. Thus a situation arises before the governments of small nations which are under pressure coming particularly from defence institutions to provide human and financial resources for research programs which in the long run will prove futile. The problem is aggravated by the fact that necessarily younger scientists will find employment in that field. Better payment and easier promotion might be attractive in the very beginning especially in view of bleak prospects in other research fields but disappointment will come later and dominate over further activities.

Europe is the most compact of all continents. Revolutionary and evolutionary developments on the continent are quickly reflected throughout the globe. The policy of research in BW defence systems makes no exeption. It is not difficult to conceive how information about such work (though defensive in character) being carried out in a particular state is commented in the neighbouring states.

Such a line of development is a matter of concern for scientists regardless of their nationality. Competent opinion about potential hazards from research work in BW even for defence purposes must be voiced time and again until a satisfactory agreement is reached: complete banning of BW and prohibition of studies for defence purposes.

Atomic Energy and the Nuclear Arms Race

I. T. Rosenqvist, Norway

Following the explosion of the nuclear devices over Hiroshima and Nagasaki in 1945, we observed a wide-spread protest from humanity directed against the atomic bomb and the scientists who had developed it. But even these colleagues took part in the protest. It therefore seemed to be a nearly compact agreement all over the world to condemn the use of scientific results, especially nuclear weapons, against man . . .

In order to overcome the ethical barrier against future construction of atomic reactors, 4 myths cropped up:

1. The conventional sources for energy will soon be exhausted.
2. The atomic reactor offers unlimited cheap energy.
3. Atomic energy will make it possible for the underdeveloped countries to compete with the industrialized countries.
4. If we continue to burn fossil fuel the CO_2 content in the air will cause a greenhouse effect so that the ice of the Antarctics will melt, and all land below 80 metres above sea level will be flooded.

The natural desire for knowledge found among scientists added strongly to the good working conditions for nuclear research. The voice of the raw material geologists concerning the energy resources of the world did not penetrate to the governments or to the people. Partly the reports from the oil companies, dictated for business reasons, concerning their oil reserves supported myth no.

At the beginning of this century the world production of oil was 20 million tons, and the oil companies said that they had only reserves for 20 years. In the years before the last war the production was 200 million tons, and the oil companies said that they had only reserves for 30 years. The production has now passed 2,000 million tons, and the oil companies tell us that they have only reserves for 40 years. All the time the reserves referred to are "proved reserves", which means oils which are accurately measured. It is interesting to notice that during the six years from 1962 to 1967 the world consumption of petroleum amounted to 9,000 million tons. In the same period the "proved reserves" increased by 19,000 million tons. This is mainly because they had measured "unproved reserves". One of the senior oil experts of the world, Lewis G. Weeks (Offshore, 20. 6. 68) estimates the ultimate oil reserves, concluding that they amount to roughly 10^{12} tons petroleum. In addition to this we have the roughly 10^{13} tons exploitable coal.

These figures are really not new; they agree with what some scientists advocated already at the time when the propaganda concerning the coming energy bankeruptcy set in in 1946.

Against this we have the conditions dealing with the energy in uranium. The world's uranium occurrences were regarded as relatively small before the last world war. Due to the intensive prospecting and geochemical research in the second half of the nineteen forties and up to nineteen sixty we have today a good background which permits us to evaluate the amounts of uranium that may be produced from the natural occurrences. Even today these reserves are small. Military and political secrecy is the reason why we cannot find in literature numbers corresponding to the "proved reserves" of the oil companies. If we look into official publications as e. g. The World Power Conference 1968, the available figure only gives 51,000 tons uranium in the cheapest price bracket. This is obviously much too low. Euratom's estimate concerning the probable reserves of cheap uranium, i. e. at a price below $20,000 per ton, is 456,000 tons. Other calculations amount to 1.3 million tons uranium in this price bracket.

Before we constructed the breeder reactors, and they were not thought of in 1946, it was only the cheapest uranium which could compete economically with conventional energy. If we turn to uranium ore which can deliver uranium oxide at a price below $60,000 per ton, we reach the order of 6 million tons, and 30 million tons if the price is set at $200,000 per ton. Using breeder reactors even these prices are not prohibitive. In competition with conventional sources of energy and with the types of reactors which are at our disposal today, only the two cheapest groups of uranium ores can deliver raw material.

Whereas the conventional sources of energy correspond to more than 1000 years of the present energy consumption of the whole humanity, the Euratom estimate of $1/2$ million tons corresponds to 1 year, and the six million tons which eventually may be produced at a price below $60,000 per ton will just about correspond to 10 years. This means 1 % of the reserves of coal and oil. Today, 25 years after Hiroshima, it seems that it is feasible to construct fast breeder reactors, making the energy content in uranium equal to the energy content in conventional fuel.

We have to assume that more and more atomic reactors will be built in the nearest future, partly because they represent a certain status symbol for the countries in which they are built, partly for political reasons because the countries want to be independent of foreign countries delivering coal and oil. For some reason they prefer to be depending upon enriched uranium from outside. This uranium is partly being dumped on the market at uneconomically low prices, often as a byproduct of the nuclear armament. It is predicted that in 1980 more than 200,000 MW electricity will be produced in nuclear power stations. This corresponds to roughly 5% of the energy consumption of the world at that time. Even though this is a comparatively small fraction, the increasing spread of peaceful nuclear reactors form a large problem regarding safeguards. Most atomic reactors are now based on enriched uranium with 3%

U235. For a country which wants to cheat in the non-proliferation agreement, this enriched uranium offers the best raw material for construction of atomic bombs. The enrichment from 0.7 % U235 involves more than 3/4 of the total cost of enrichment in order to obtain 100 % U235, or a purity which may be used in atomic bombs. Even though it is more difficult to hide a secret enrichment for atomic armament than to hide a production plant for bacterial and chemical weapons, it is nevertheless obvious that the spread of large amounts of nuclear fuel involves a danger. We have experienced, and we are going to experience – unscrupulous statesmen.

In addition we have to remember that exploitation of uranium in the higher price groups will spoil the environment even more than the stripmining of Kentucky. The Scandinavian alum shale is considered as uranium ore in the middle price group. To extract it would lay waste hundreds of sq. kilometers of picturesque areas in Norway and Sweden.

The atomic reactors have to be large, i. e. above 500 MW, in order to compete with coal and oil, and a power station is valueless if there are no machines which can consume the electricity produced. Therefore, the atomic power stations are mainly an advantage for the strongly industrialized countries, and they represent a nearly useless source of energy for the underdeveloped countries which are poor because they lack capital, but have people. Thus it is depressing to remember that this spread of nuclear power stations had been totally unnecessary in this and the next century.

In the later years we have seen more and more propaganda for the fourth myth, i. e. the greenhouse effect of the increasing CO_2 concentration in the atmosphere. We do not have to penetrate into this matter. It is sufficient to point to the contradictions in various calculations and research. Nevertheless, from certain sources it is steadily announced as a fact that if we continue to use conventional fuel – which nobody now denies is present in sufficient amounts – all harbours and lowland below 40–80 metres above sea level will drown when the ice in the Antarctics and Greenland is melting. That the whole thing is based on lopsided arguments does not reduce the fear for conventional fuel and the belief in atomic energy...

In all cases the reason was the same, namely the need of convincing their own people of the benefits of the research, and that atomic weapons represented regrettable byproducts from the beneficial atomic energy.

I willingly admit that one day the conventional sources of energy will be exhausted, and also that it is possible that nuclear energy may be cheaper some places, but this is still far ahead of us, and nobody can predict the technological development in the far future. Today a certain amount of nuclear energy involves certain advantages. It may reduce the influence of the air pollution coming from conventional power stations, and the amount of Kr85 and H3 which is spread from the relatively few reactors commiccioned today is trifling. If however, one day in the future we could imagine that all energy corresponding to 10^{10} tons coal should be produced by nuclear power stations independent of whether this happens in a conventional reactor or in a breeder reactor, the poisoning due to the uncondensable radioisotops Kr and H will represent serious problems, even if they were distributed in the total atmosphere and the total oceans. The reason why we today tolerate the small increase in radioactivity is that two principally different types of pollution as radiation and chemicals do not act additively.

Potential Dangers to the Development of Society Caused by the Abuse of Psycho-Toxins

E. Scheer, GDR

Psycho-toxins are weapons directed against the further existence of an independently thinking and acting society. The danger to social development lies in the deliberate use of psycho-toxins for the purpose of contaminating large groups of people.

The ruin of both health and economy of a nation of millions was brought about in the last century by forced abuse of opium. The decay of the Chinese people, which lasted for decades, was accompanied by military conflicts which have gone down in history as the Opium War (1839-42; 1854-60)[1]. The first International Opium Conference held in Shanghai in 1909 marked the beginning of efforts to stop the abuse of opium. Later, the League of Nations and the United Nations adopted strict guidelines governing the production and distribution of narcotics.

In the recent past the use of such psycho-toxins as LSD, hashish and heroin has spread like an epidemic, particularly among young people in Mexico, the USA and Western and Northern Europe. However, this epidemic is confined to states with a capitalist social order. Every fourth young person in the Federal Republic of Germany between 13 and 19 years of age has come into contact with psycho-toxins; the number of cases of early invalidism among young people in the FRG who are unable to complete their school and vocational training has already reached 60,000.[2] Mueller[3] assesses the further development as follows:

> *"First attempts are being made to manufacture these substances synthetically; if they are successful the effects on pharmacomania will be even more disastrous than in the past."*

The news of heroinism among US troops fighting in Vietnam is alarming. One may assume that the army command not only approves of this situation but considers it even advantageous to put the troops into a state that can be manipulated. Heroin is now regarded as one of those toxic substances whose abuse has been pointed out by the WFSW Conference on the chemical war in Vietnam.[4]

According to a report of Amnesty International, another psycho-toxin is used against imprisoned civil right fighters in Northern Ireland, which produces hallucinations.[5] Psycho-toxins have become particularly dangerous chemical warfare agents. Their distribution and application require no sophisticated weapons systems. They are weapons of psychological warfare. Psycho-toxins belong to those chemical weapons whose production and use must be prohibited without reserve.

Scientists recognized rather early that LSD and Ditran as psycho-toxins with potential properties are suitable as chemical warfare agents. Aware of their responsibility as scientists, they have pointed out the potential dangers to social development.

Soon after the first reports on a new synthetic anticholinergio psycho-toxin-piperidylbenzilate—had appeared in medical journals[6], Dubinin[7] warned of the danger of abusing the highly toxic psycho-toxins as chemical weapons. This warning was taken into account by the Fifth Pugwash Conference on Biological and Chemical Weapons. The dangers to mankind were assessed as follows:[8]

> *"New types of hallucinogens or toxins that produce temporary psychic disturbances without causing perceptible lasting damages were endorsed as a means of "humanizing" war. Though they do not kill directly, their application could have serious effects, because individuals or groups exposed to these agents frequently act in an unpredictable and irresponsible manner."*

The effects of this type of toxins are compared with certain types of atomic weapons. The Conference also strictly opposed the trend to regard BC weapons as "more humane" than conventional weapons. The above classification and definition of psycho-toxins was very far-sighted, considering the state of scientific knowledge in 1959. Basic neurophysiological and biochemical knowledge of the higher nervous system was not generally available. Psychopharmacology had just started to develop into and independent field and to gain information by way of electrophysiological and biochemical methods on the influence of the new active agents on the higher nervous system.

In his paper "LSD, ein Phantastikum der Mutterkerngruppe" a hallucinogen of the ergot group)[9], Stoll described in 1947 the psychic effects of LSD. In 1943, the chemist Hofmann accidentally swallowed some LSD in his laboratory. He experienced symptoms of poisoning with a sensation of dizziness and restlessness and saw things as they appear in mirrors with curved surfaces. The symptoms were reproduced in healthy and ill patients by deliberately administering LSD to them. LSD produces depersonalisation and the loss of temporal and local orientation ... In 1953, Frederking [10] started to use LSD in psychoanalysis in order to clarify subconscionsciousness" ...

Our own experiments revealed that doses of 50 to 100 mg of LSD completely suppres the normal basic bioelectric activity of the brain. Prior to any changes in the behaviour, we registered an abnormally flat and rapid basic activity attended by paroxysmal retardations of 5 to 9 seconds each[11]. Our findings have parallels in the electroencophalograms of epileptics with twilight-states.[12]

Even today LSD is used in some countries for the socalled psycholytic psychotherapy. Epilepsy and heart diseases, however, are recognized as contraindications. According to the stipulations of our Drug ACT, the therapeutic value of LSD is regarded in the GDR as scientfically unproved.

Since 1965, LSD consumption has been centred on nonmedical purposes.

Psycho-toxins with central anticholinergic effects have been developed by the Lakeside Laboratories. These substances have been synthesised in order to obtain medicines for treating depression. Of the piperidylbenzilates and piperidylglucolates, Ditran has been investigated in detail.[13]

The intoxication of healthy test persons is followed by 20 hours of manifest behaviour disorders. The conduction of information processing is erroneous, orientation in the environment is impaired, and there is a dissociation between information and action. The intoxicated person has hallucinations which prompt him to act. After the acute effects have subsided, all experiences are blotted out by amnesia.

The effect on the behaviour takes place via a chemical intervention in the integrative activity of the higher nervous system. The cause of any human behaviour, of any activity of an organism is the action of the environment on the nervous system. The flow of information from the environment impinges on the receptors, and is conducted to the brain by chemical transmitters via synapses.

Higher nervous activity integrates the functional reflection of the objective environment in the analysers as a sum of new data and old experiences into purposeful biological reactions. The morphological substrate represents the most developed structure of animate nature. The human brain comprises—15 thousand million neurons and their synaptic contacts. Assisted by synapses, information is transmitted from the presynaptic to the postsynaptic part by way of chemical transmitters. Acetylcholine is known as a transmitter of the faster processes, noradrenaline of the slower ones. After the information has reached the specific chemical receptor at the post-synaptic membrane, the biologically highly active transmitters are inactivated by a fermentative mechanism, re-absorbed and stored. The target of such warfare agents as nerve agents, plant-killers and insecticides is cholinesterase—an inactivating ferment. The results are signs of poisoning in the target organism.

Psycho-toxins attack central structures that act as receptors for transmitters.

L. G. Abood studied the mechanism of action of piperidyl-glucolates on the morphological substrates of the higher nervous activity. Radioactive marked substances are detected at the chemical receptors for acetylcholine.[14] Thus, changes in the behaviour effected by psycho-toxins of the Ditran type are caused by the displacement of the transmitter azetylcholin from its place of action.

C. Bell and S. Gershon[15] conducted in 1964 comparative studies of Ditran and the ten times more effective 3-quinoclidinole-benzilate.

The fact that the two psycho-toxins act on the cholinergic mechanism of the brain activity in connection with behaviour disorders has been confirmed. Furthermore, a disturbance of the equilibrium of the adrenergic mechanisms is supposed to take place.

The hopes of the scientists to have developed drugs suitable for treating depression have been realized. On the contrary! US secret research work exploited the negative experiences in order to develop the agent known as BZ.

The chemical composition of the psycho-toxin BZ remains a military secret. A WHO group of consultants[16] assumes, however, that chemically and pharmacologically BZ is akin to Ditran or 3-quinoclidinole.

Occasionally the view is expressed that BZ, a product of secret research, is not a very effective chemical weapon. It is not our task to assess the quality of this agent. We scientists condemn any use of scientific capacities for developing chemical warfare agents. We support international agreements aimed at implementing humanitarian principles in the development, production and use of chemical substances. Any form of secret research designed to cause disease or death in man, animals and plants is in contradiction to these principles.

In the above report of consultants, LSD and BZ are classed as potential chemical agents under the term "psycho-chemicals". In my opinion, this neutral term "psycho-chemicals" considerably tones down the meaning as compared with the term "psycho-toxins" suggested by Dubinin in 1959.

It should always be made-clear that, because of their effects such substances are actually psycho-toxins, and psycho-toxins are as dangerous chemical agents as are nerve toxins...

The target of psycho-toxins is man's higher nervous system. Application and abuse mean the separation of man from the real awareness of his environment by chemical means.

The chemical disturbances of thinking and consciousness deprive the individual concerned of the most human of qualities: to analyse a situation and to act purposefully in line with his own decision. Chemical intervention in the higher nervous activity also prevents the creative transformation of reality.

The potential threat to the development of society lies in this aspect of the effect of psycho-toxins. It is the scientist's responsibility to point out these dangers in time. The call for an absolute prohibition of the development, production and use of chemical warfare agents is, and will be, society's most effective protection from the abuse of scientific results.

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The Dangers of ABC Weapons in Japan

S. Shibata, Japan

Japan has played an important and dangerous role in the strategic plans of the USA, ans still does so today. The US forces are maintaining 289 military bases in Japan including Okinawa, which serves as a base for the aggression in Indochina. Without these bases in Japan, the US operations in Indochina would have encountered serious difficulties.

Recently the Okinawa Council against A and H Bombs disclosed that more than 3,000 nuclear warheads of about 20 types were at present stored on that island. The US/Air Force disposes over tactical warheads for F-106 fighters. Some 70 F-105 aircraft are permanently stationed at Kadena Air Base, and their warheads are stored in Chibana and Yomitan, Okinawa. The army, which mainly relies on surface-to-air Nike-Hercules missiles, also disposes over surface-to-surface missiles such as Honest John and Little John. At the Navy's nuclear arms depot at Henoko, Okinawa, there are stocks of Subrock mines, aircraft-carried Sparrow and warship missiles (Telos). Surface-to-surface missiles such as Sergeant, SS-10 and SS-11 are stored at Chibata and Henoko for the Marines.

The Japanese people are also facing the serious problem of sea-water pollution caused by US nuclear-driven submarines and aircraft carriers, which have run in at Japanese ports approximately 60 times. High radioactivity has been found in the sea-water at ports of call such as Yokosuka and Sasebo. Experts have warned that the pollution of sea-water by US nuclear warships would contaminate the fish in the sea around Japan and thereby endanger the health of the Japanese people.

In August 1967 the Minister for Social Welfare of the DRVN, Van ngoc Thac, chairman of the DRVN Commission for the Investigation of US Imperialist War Crimes in Vietnam, revealed to me that some members of No. 406 unit (US Army Medical Research Centre) were sent to South Vietnam for biological warfare purposes. This unit is stationed at Sagamihara City near Tokyo and plays an essential role in B-strategy in the US war in Indochina. According to the daily paper *Akahata* of September 1st, 1965, the 406 unit's Medical Institute comprises special departments for bacteriology, chemistry, biophysics, insects, immunity, parasites, pathology, sera, poisons, veterinary medicine, viruses and rickettsia. Pathogens of epidemics from all over the world, in particular those found in Asia and Africa, are being cultivated there. At the departments for viruses and rickettsia, black plague, cholera, typhus, polio, smallpox and Korean epidemic fever are among those investigated.

There is also a chemical warfare unit (US Army Technical Headquarters, Chemical Department) in Asaka City near Tokyo. It must be assumed that B and C weapons are being stored at ammunition depots of the American forces in Japan, since there are B and C corps within the units of each division.

The research and development of poison gases by the Japanese Self Defence is described in the Technical Research and Development Plan of the 3rd Defence Programme as "Research and Development Plan for Non-Lethal Chemicals". The fiscal budget for 1968 allocated considerable sums to tear and nerve gas. Within the scope of the plan for 1967-1970 experiments are being conducted for the development of spraying devices for chemicals ...

It is very difficult to ascertain with precision the number of people who were killed by the atom bomb dropped on Hiroshima. The most reliable figures available are those quoted in the "White Book on the Damage of Atomic Bombings", compiled by the Japan Council against A and H Bombs This report estimates the death toll by the end of 1945 at 150,000–170,000 people, and, citing census figures of October 1950, mentions a total of 220,000–250,000. It is estimated that tens of thousands of Hiroshima residents died from the delayed effects of the bomb within the five years after the raid, and that the death toll in Hiroshima City alone had by then exceeded 200,000. According to statements by the municipal administration some 70,000 residents of Nagasaki were killed in the bombing of that city. It is not known whether this figure includes servicemen and civilian employees killed in barracks. The census of 1950 showed an atomic death toll of 120,000.

In addition to these deaths the bombs caused a large number of other victims. The census of 1950 revealed a total of 292,051 survivors of the calamities of Hiroshima and Nagasaki scattered throughout the whole of Japan, so that one out of every 300 Japanese continued to suffer from the effects of the bombs. Furthermore there are many people who were only recently discovered to be bomb victims. The frequency of certain diseases, such as leukemia, anemia and various sorts of cancer, is very much greater in Hiroshima than anywhere else in Japan. Their frequency becomes increasingly intense in the immediate proximity of the epicentre of the atomic explosion. They may be the result of atomic radiation.

There is also the problem of the second generation of victims. Young people born at the time of the bomb explosion or shortly after are worried about their future. Girls of that generation cannot marry, because families do not want their sons to marry a Hiroshima girl in case the disease would affect the third generation. Nobody knows at what moment the survivors of the atom bombs might suddenly show the above mentioned symptoms and how many generations will suffer from the after-effects of radiation. I have no space here to speak about the US nuclear test at the Bikini Atoll in 1954. In only want to mention the fact that one member of the crew of a Japanese fishing boat was killed and all the other members suffered health injuries through nuclear ashes. Apart from the dangers of the use of atomic weapons in the past, we Japanese are facing the present dangers of atomic weapons stockpiled by the US imperialists. With the progressing stockpiling and deployment of nuclear weapons, as demonstrated by the "port call" of US nuclear-driven submarines and aircraft carriers, the departure and arrival of B-52 bombers carrying nuclear weapons, the development of nuclear missiles, etc., Japan is clearly being transformed into a nuclear arms base.

Japanese scientists in the struggle against ABC weapons

We are of the opinion that as long as the US imperialist aggression in Indochina continues, the dangers of ABC weapons in this area will not diminish. During the past 26 years the Japanese people have continued to struggle against nuclear weapons. This struggle is symbolised by appeals such as: "No More Hiroshima!" and "Do Not Allow Hiroshima or Nagasaki to be Repeated in Vietnam!"

As a result of the whole-hearted cooperation of many overseas delegates from five continents and international organisations and ten thousands of Japanese delegates from all over the country, the 17th World Conference against A and H Bombs on August 7th 1971 issued the "Hiroshima Appeal For Joint International Action", calling all peace-loving people in the world to join in the struggle with the following aims:

- an immediate end to the US war of aggression in Indochina; full support to the proposals made by the Provisional Government of the Republic of South Vietnam; condemnation of the war crimes of the US and their accomplices; prevention of the use of nuclear weapons in Indochina;
- prevention of nuclear war, complete prohibition of nuclear weapons, and immediate conclusion of an agreement banning the use of such weapons; prohibion of the proliferation of nuclear weapons to foreign countries; establishment of nuclear-free zones covering the Asian Pacific, the European Mediterranean area, including West Germany; opposition to the Amchitka underground testing of nuclear arms and to the development and production of such weapons; struggle for the complete prohibition of B and C weapons;
- opposition to renewed war provocations and nuclear coercion policy by the US imperialists in Korea; liquidation of foreign military bases; abolition of all military blocks and establishment of a genuine system of collective security; conclusion of an agreement on general disarmament;
- opposition to the nuclear armament of Japan and West Germany; opposition to the Okinawa agreement and the continued maintenance of nuclear bases; struggle for the unconditional and immediate return of Okinawa; abrogation of the US-Japan Security Treaty; opposition to the revival and reinforcement of Japanese militarism in subordination to the US; opposition to the militarism and expansionism of West Germany;
- reinforcement of relief activities for atom bomb victims and fulfilment of their

demands; termination of the American Atomic Bomb Casualty Commission (ABCC) and its nuclear war preparations; enactment of a relief law for A-bomb victims, etc.

Since the A bombs were dropped on Hiroshima and Nagasaki Japanese scientists have continued to study and disclose the inhuman effects of nuclear weapons and to discuss the results of their investigations with the people. They have also investigated the pollution of air and water caused by a number of nuclear tests and by "port calls" of US nuclear-driven submarines and aircraft carriers. They repeatedly sent investigation teams to Vietnam as well as to military bases in Japan, including Okinawa. Many experts of natural and social sciences have cooperated in throwing a light on the numerous scientific, technological, medical, economic, political, sociological, juridical and military theoretical aspects of ABC weapons. Without such efforts of scientists the mass movement against ABC weapons, the US war in Indochina and the US military bases in Japan could not have experienced such an upsurge as it did in recent times.

Japanese scientists have developed many new forms of cooperation between scientists and the people. These include: the movement to organise the Tokyo and Nagoya Tribunals to denounce US war crimes in Indochina and cooperation in those crimes by Japanese financial circles; the organisation in support of the International War Crimes Tribunal inspired by Bertrand Russell; investigation teams on pollution caused by ABC weapons; the Experts' Committee of the Japan Council against A and H Bombs.

One of the most splendid achievements of Japanese scientists is the enactment of a fundamental law on atomic energy. This act incorporates three principles of atomic energy research in Japan: independence, democracy and free access. All scientists working in the field of nuclear physics are requested to respect them. Needless to say, these principles should be extended and applied to all spheres of science. This is one of the most urgent tasks of the scientists' movement in Japan.

In these struggles the democratic organisations of scientists, like the Japan Scientists' Association and the trade unions of professors and research workers have played an important part. We should in particular mention the importance of the trade unions of workers in atomic energy, national health, agricultural technology and other institutions, which repeadedly warned the public about the significance of the Japan Science Council, the members of which are democratically elected by all scientists of Japan. On October 24th, 1969 it adopted a recommendation in its capacity as an advisory organ of the goernment, calling the Japanese government to ratify the Geneva Protocol of 1925 as Genevoa as possible, and to declare that Japan would never engage in the research, manufacture, stockpiling, import or use of B and C weapons.

United with their colleagues all over the world, Japanese scientists will do their best to put an end to the use and the dangers of ABC weapons in Indochina and Japan.

Possibilities of Disarmament

Disarmament and Public Health Service

M. von Ardenne, GDR

(The author expounded a number of ideas resulting from research work carried out in order to control pathogenetic causal processes, and possibly acquiring special significance if general disarmament set free the existing research capacities exclusively for peaceful purposes all over the world. This is a summary account of what he said.)

In 1956, in a speech made before the National Front of the GDR, the speaker submitted and substantiated the proposal to use for peaceful purposes, within the framework of complete general disarmament, the world stocks of nuclear explosives accumulated for military purposes by utilizing them for the generation of electric energy and heat in nuclear power stations. During the past 15 years, this obvious idea has gained ever increasing topicality because the world stocks of nuclear explosives have increased tremendously during that period, and because today the surfaces of whole continents including all forms of life thereon can within minutes completely be destroyed thermally and with a density of energy hardly differing from one place to another, due to the development of carriers for nuclear charges controlled with spot-on accuracy. This most horrible variant of a nuclear war would occur if a great number of nuclear superbombs were simultaneously ignited at a given altitude and at given distances, i.e. if sort of point-lattice geometry were applied. The simultaneousness of ignitions would multiply the maximum density of energy on the surface of the earth, and the great number of simultaneously dropping superbombs would put the locating and defensive systems out of action.[1] The alarming physical possibility of such a crime of cosmic extent optimized by means of computers and directed against mankind, the numerous declarations given mainly by the Soviet Union, but also the constantly increasing financial strain placed on peoples by armaments expenditure becoming ever more senseless made the prospects of international disarmament considerably increase. In view of the coming into reach of world-wide disarmament agreements looked forward to by the simple citizens of all countries, the governments of all states burdened with large armaments expenditure should very thoroughly examine the question of how to use the extensive research and production capacities set free by disarmament in order to avoid economic crises and unemployment. In fact, there are already many open and secret studies dealing with the complicated problems arising in connection with the most efficient utilization of these capacities for the improvement of living conditions. The highest ethical form of their employment would be their utilization for purely humanistic purposes. When analysing the more subtle structure of research centres and of industries built up for armament production we arrive at the pleasant fact that engineering facilities existing in many fields of arms production can easily be reconverted for setting up a huge medical industry.

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[1] M. v. Ardenne, Foreword to the book by Linus Pauling "Leben oder Tod im Atomzeitalter" (Life or Death in the Atomic Age), Aufbau-Verlag, Berlin, 1964.

Hence, the revolutionizing of the world health system should be one of the main consequences of general disarmament. The highly developed electronics and mechanics of the armaments industries could be used for improving medical electronics and biomedical technology. Numerous enterprises in the chemical armaments industry could be reconverted for the industrial production of highly nutritive food and fodder and above all of modern pharmaceutical products which should be available to every inhabitant of the earth. In the field of prophylactic nutrition as a means of preventing a great number of diseases enormous tasks are still waiting to be tackled. Furthermore, considerable industrial capacities should be used for diminishing environment pollution which has become such a critical problem by now.

The spoon-fed computer technology of armaments industry and astronautics together with the available arsenal of measuring instruments and therapy equipment could be used for automatically and quickly obtaining diagnoses with a high degree of certainty as well as for optimizing the therapy of diagnosed diseases. A vast field of activities for researchers, scientists, engineers, craftsmen and workers employed at present in the armaments industry is showing here very clearly.

(In the following part of his lecture Manfred von Ardenne spoke of the possibilities of increasing man's age in general and his physiological age in particular, and of mitigating his physical complaints. The speaker concluded his "Appeal to Common Sense" by saying:)

Very large parts of the capacities used so far for military research and production can be reconverted for combatting still uncontrolled diseases such as rheumatism, mental diseases, diseases of the peripheric nervous system etc. Out of the great many diseases I just want to mention two belonging to the latter group, namely diabetic neuropathy and multiple sclerosis–diseases associated with great and long sufferings. These are probably manifestations of a degeneration of the blood-nerve barrier discovered by us in 1970 and formed by enveloping windings of plasma membranes which have been known as Schwann's cells for a long time.

The same toxicologists who today misuse their science for inhuman purposes by developing horrible nerve agents, could be directly employed in this field in order to contribute to mitigating human sufferings by applying their latest knowledge with regard to the blood-nerve barrier. This is one of the field's where the two extremes in the use of the exact natural sciences for or against man are confronting each other with particularly startling clarity.

At the same time this study is an appeal to all medical men in the world to spare no efforts during the next few years which will be decisive for the destiny of mankind; it is an attempt to contribute to the preparation of reconverting armaments industries for humanistic tasks for the benefit of the people, and above all an appeal to common sense lent more weight to by concrete and exciting examples.

Disarmament and International Law

P. Cot, France

I would like to begin my lecture by making two general remarks. First of all I would like to stress the role played in disarmament by the lawyer or the scientist. A lawyer or scientist may well submit proposals, give advice and study questions pertaining to his special subject, but he is not in a position to take any decisions. In the field of disarmament–just as in many others–the taking of decisions rests with those exercising political power. And I should like to add that this is completely normal. The role of political power–be it a good or a bad one–consists in making a synthesis and in taking into consideration all the factors there are to be considered. The task of the lawyer or the scientist is more limited.

Secondly, it must be pointed out that although a positive situation has been achieved in present international law (as is proved by what the states are actually doing) there are, however, no legal obligations binding on the individual states. There is a moral obligation, and there is a political one.

The political obligation mainly follows from the treaties concluded after the Second World War, and above all from the principles of international law as laid down in Article 2 of the United Nations' Charter. According to Article 2 the use of force–and what is even more symptomatic–the threat of force is prohibited. In Article 2 we come across the principle that all problems should be settled by peaceful means. There are various ways of doing this, some of which are even listed, but there is no obligation to do so. Several national and international possibilities exist for bringing about a peaceful settlement of problems, such as negotiations, agreement, voting and arbitration, but in all cases the use of force is prohibited. Neither is interference in internal affairs allowed for this is the sole concern of each individual state. So you see, there is no legal obligation for disarmament.

On the contrary, the UN Charter bases itself on the assumption that a certain undetermined level of international armament is retained. The whole system permitting the Security Council to express its will (as outlined in Article 7 of the UN Charter) proceeds from the use of national armed forces. Pursuant to Article 42 and the following articles the Security Council may, of course, request states to place troop contingents at its disposal. The fact that UN members might not have any troop contingents or produce arms is something not contemplated. This finds its expression also in other principles, for the member states are granted the right of defence. This means that the Charter also takes the existence of national armed forces for granted.

The problem of disarmament is now being tacklad. Two methods may be applied here: the global method aimed at convening an international disarmament conference, and the step-by-step method which implies negotiating treaties on certain points. It is, in fact, the step-by-step method which has been applied with a certain amount of success during the last few years. There is the Moscow Test Ban Treaty, the Non-Proliferation Treaty, the Sea-Bed Treaty, and above all the draft treaty prohibiting the development, production and storage of chemical and biological weapons. These treaties are important steps on the road towards disarmament, but this does not mean that the convocation of an international disarmament conference would be useless. On the contrary, such a conference would mobilize and shake public opinion into action by informing it about the constantly growing dangers ensuing from the present policy of increasing arms stocks...

The step-by-step method has yielded quite a number of successes which I should like to outline here. Seen from the purely legal point of view I must say that this method might have certain disadvantages. Suppose we do not achieve a general, but only a partial prohibition of atomic or other weapons. In such a case lawyers might say that the general prohibitions proposed by the The Hague Conferences, and in particular those covering chemical and biological weapons, had lost their value, and that these general prohibitions had been replaced by special conventions.

As regards the non-proliferation problem some headway is being made at present. This progress could and ought to be seen in connection with the whole range of measures, also in connection with the monopoly held by the present atomic powers. You all know that the convention which has been worked out prohibits atomic powers from passing on atomic weapons to countries not possessing such weapons. At the same time it guarantees that the secrecy surrounding atomic weapon production is maintained. Furthermore, it prohibits non-atomic powers to produce atomic weapons and enlarge probably existing production capacities. This step forward should not be underestimated.

But this gives the non-atomic powers the impression that discriminatory measures are being launched against them as it were. This discrimination is all the more annoying since the developing countries, which play a very important role in laying down the rules for the application of international law, react to it most vehemently. In the not so distant future this could become a serious problem if these very countries were of the opinion that the majority of atomic powers had laid down an unjust distribution scheme, i.e. the industrialized countries continued to have the right to possess and produce atomic weapons, whereas the others were deprived of this right.

The preamble to this convention has to be seen in a certain light. It is clearly stated therein that the present monopoly of atomic weapons by the Big Five has to be regarded as a questionable one, since one day these weapons will necessarily be prohibited for all powers. It is up to us now to work for this goal. But it must be said here and now that the principle of non-proliferation of atomic weapons must be adhered to in order to stop this great evil from spreading beyond the five states. Seen from this angle it is necessary for the Big Five to make it quite clear to the non-atomic powers, and especially to the developing countries, that it is not only a vague intention on their part, but that they are firmly determined to proceed from the existing treaty and to achieve general disarmament.

The next point deals with the machinery set up to promote disarmament. It is the well-known 18 Nation Committee which, strictly speaking, is only still called so out of mere habit. In the beginning the Committee consisted of 17 members because France initially refused to participate in it, and today it has 25 members. The Committee is doing an excellent job. Every year it has to account for its work to the UN General Assembly. Since this Committee came into being concrete progress towards disarmament has been achieved.

I am now coming to the last and probably most important problem–the banning of chemical and biological weapons. These weapons are extremely dangerous... They might even endanger the very development of the human race, for their use can cause dangerous forms of deformities etc. detrimental to future generations. Rightly or wrongly–I hesitate to enlarge upon these dangers before such a gathering of specialists–the chemical and biological weapons are generally called the "poor man's atomic weapons"... In other words, if the great powers do not achieve a ban on all mass destruction means we run the risk of smaller countries responding politically with a weapon to which they have access and which is not yet banned for them–be it in order to possess a means of mass destruction of their own or to achieve a prohibition of the other weapons–, and that is why I have drawn your attention to the psychological aspect of this question...

Seen from the point of view of international law the draft treaty on the prohibition of chemical and bacteriological weapons is particularly interesting because of the debate on the value of the Protocol of 1925. Most lawyers rightly feel that the 1925 Protocol has a declarative rather than a normative effect. It has legalized a custom, and just as an agreement a custom is a source of positive law. The new draft treaty, which has been submitted for signature to all states, should not only result in confirmation of the ban on using means of mass destruction but also in the destruction of existing stocks of chemical and bacteriological weapons...

I have to bring my talk to an end now. First of all I would like to say that I am very happy to be able to participate in this discussion. Furthermore, I have been most impressed by the information we have received here. It has shown that in reality the situation is more difficult and much graver than I thought it was. Besides, it has opened my eyes to the large gap between the actual dangers and the possibilities which exist of averting them. Nevertheless I shall not come to any pessimistic conclusions... For you as scientists and for us as lawyers the main task and duty consists in pointing out the consequences of these dangers. We have to make even greater efforts than in the past . . .

In conclusion, please permit me to cite Montesquieu whose words I would like to urge upon you:

> *"If I were to do something that did not benefit myself and my family I would abstain from doing it. If I could do something that would benefit my family, but would be to the detriment of the society in which I live, I would also abstain from doing it. If I were to do something in line with the interests of my country, but contrary to the interests of all mankind I would call it a crime."*

Disarmament and International Law

B. Graefrath, GDR

When scientists, aware of the great danger which ABC weapons constitute for the whole of mankind, fight for their ban and for effective disarmament, then this is not only justified in moral and ethical terms: it is also fully in keeping with present-day international law which is marked by a comprehensive ban on the use of force, as reflected in the Charter of the United Nations, Article Two, Paragraph Four. This ban is the clearest manifestation of the new quality, introduced into international law after World War Two. Once focussed on the right to make war and sanctioning colonial rule, international law has come to give priority to banning the use of force and to the duty of states to work for peace based on respect of their sovereign equality. This transformation reflects the tremendous change in the international balance of power.

The comprehensive ban on using force and the general obligation of states to take part in peaceful international cooperation, which has now become an indispensable element of their sovereignty, imply their obligation to join hands in working for disarmament. This is so because it is not just the use of force but even the threat of using force which is contrary to international law. The duty under international law to draft measures of disarmament is nowadays not just a thesis propounded by progressive international law experts but rather the clear legal position of states and has been expounded in a great number of international documents. The United Nations Declaration on Principles of International Law states in its definition of the ban on force:

> *"All states shall pursue in good faith negotiations for the early conclusion of a universal treaty on general and complete disarmament under effective international control..."*

The Treaty on the Non-Proliferation of Nuclear Weapons, which took effect in 1970, says in its Article VI:

> *"Each of the Parties to the Treaty undertakes to pursue negotiations in good faith on effective measures relating to cessation of nuclear arms race at an early date and to nuclear disarmament, and on a Treaty on general and complete disarmament under strict and effective international control."*

An obligation to this effect was laid down as early as 1963 in the Preamble to the Moscow Nuclear Test Ban Treaty. Taking the shape of a call on states, it can be found even earlier in Resolution 1378 of September 20, 1959, of the Fourteenth UN General Assembly Session.

The duty of states to work for peace, which also includes the renunciation of the threat of using force against the political independence and territorial integrity of states, does not mean laying down by treaty in international law a balance of terror, a definite level of armaments, but clearly means entering into the obligation to reach agreement on disarmament. International law is also the instrument for carrying out agreements on disarmament between states. The preparations for and conclusion of agreements on disarmament have to be governed by the general principles of international law, such as the principle of sovereign equality and the prohibition of discrimination. It must therefore be made possible for every state to enjoy equality when taking part in the preparations for and the conclusion of agreements on disarmament. A policy seriously seeking to conclude agreements on disarmament is inconsistent with a policy of discrimination as pursued, for example, towards the German Democratic Republic, the GDR, up till now.

The obligation to disarm can be met either by an all-embracing agreement on general and complete disarmament or by agreements on partial disarmament. A large number of proposals have been put forward on both items, especially by the Soviet Union and other socialist states. The German Democratic Republic has, on several occasions, made proposals on partial disarmament and also disarmament with regard to itself and the FRG, the Federal Republic of Germany. Of particular importance are those partial disarmament proposals which refer to the ban on manufacture, testing and stockpiling of ABC weapons since these weapons are uncontrollably destructive.

As regards ABC weapons, the general need in international law for agreeing on disarmament measures–a need which ensues from the ban on using force or the threat of it–is reinforced by the fact that there *are* additional clear bans on the use of nuclear, chemical and biological weapons. In this context, an agreement on disarmament will serve to safeguard an already existing ban.

The Institut de Droit International, in a resolution of September 1969, described the general ban in international law on the use of weapons of mass destruction as follows:

> *"Est interdit par le droit international en vigueur l'emploi de toutes les armées, qui par leur nature, frappent sans distinction objectifs militaires et objets non militaires, forces armes et populations civiles. Est interdit notamment l'emploi des armes dont l'effet destructeur est trop grand pour pouvoir être limité à des objectifs militaires déterminés ou dont l'effet est incontrôlable (armes "autogénératrices"), ainsi que des armes aveugles."*[1]

"It is forbidden by international law at present in force to use any weapons which are of such a nature that they strike military and non-military objectives without distinction. It is forbidden in particular to use weapons of which the destructive effect is too great to be able to be limited to determined military objectives or which have uncontrollable effects ("self-generating" weapons, as well as blind weapons").

There is no doubt that this refers to nuclear, chemical and biological weapons.

Way back in 1961, the United Nations General Assembly, in its Resolution 1653 (XVI), confirmed the ban on the use of nuclear and thermonuclear weapons. In full agreement with the overwhelming majority of the world's experts on international law, the General Assembly invoked the general norms of bans of this kind, which go back as far as the St. Petersburg Declaration of 1868, the Brussels Declaration of 1874, the Hague conventions of 1899 and 1907 and the 1925 Geneva Protocol. All attempts to authorize or justify the use of so-called tactical or "clean" nuclear weapons are doomed to failure in view of the way these weapons operate, which the Secretary General of the United Nations described in convincing detail in his 1967 report on the effects of the use of nuclear weapons (A/6855).

These norms also prohibit the use of chemical and biological weapons. This was made clear beyond all doubt by the United Nations General Assembly in its Resolution 2603 (XXIV) of 16th December 1969.

This resolution confirms that: –

(1) The ban on the use of chemical and biological agents in international armed conflicts is a generally recognized rule of present-day international law, which is laid down, in particular, in the Geneva Protocol and which is binding for all states today;

(2) The ban covers all chemical agents of whatever type, be they lethal or not; it relates to Napalm as much as to tear gas and other irritant gases;

(3) The ban applies to all biological agents; it does not differentiate between bacteriological and other agents, i.e., it even comprises viruses, toxins and their vectors;

(4) The ban embraces the use of chemical and biological weapons against man as well as plants and animals;

(5) The ban refers to agents of chemical and biological warfare regardless of whether they already exist or become available in the future in the wake of the advance of science and technology.

It was exactly these unequivocal statements contained in the Resolution that did not suit the representatives of the United States, Australia and Canada and some of their allies because they frustrated all vague statements and considerably restricted the ways of getting round the ban.

Resolution 2603 (XXIV) neither introduced new bans nor gave a "wide" interpretation to existing ones. Its legal merit is to have described the valid law in full consideration of the progress made by now in science and technology.

One of the oldest restrictions in the laws of war is the prohibition of poisonous or poisoned weapons; this was emphatically pointed out in a report by the Secretary General of the United Nations (A/7575). Obviously, the Geneva Protocol is based, in particular, on the general prohibition of poisonous weapons in Article 23a of the Hague Convention respecting the Laws and Customs of War on Land and the specific ban on gas projectiles in the 1899 Hague Convention.

That the use of all chemical warfare agents was already banned in the above mentioned Article 23a of the Hague Convention is, incidentally, proved by Article 171 of the Treaty of Versailles, which, basing itself expressly on the existing ban, states:

> *"Since the use of asphyxiating, poisonous and similar gases and all corresponding fluids, agents or procedures is banned, their manufacture in Germany and their import is strictly forbidden."*[1]

Thus, the Treaty of Versailles itself merely added bans on manufacture and import to the one already in use, and was thus worded as early as 1919 to embrace as much as the Geneva Protocol did a little later. All nations involved in this Treaty and the rest of the separate agreements thus confirmed the comprehensive ban on all chemical warfare agents. This was done again a few years later, in 1922, in Article Five of the Washington Agreement. The Geneva Protocol did not, therefore, lay down a radically new ban. It simply confirmed the general validity of an existing ban and defined it more clearly by expressly extending it to bacteriological weapons. And according to the scientific knowledge of that time, the term "bacteriological" was meant to comprise all agents of biological warfare.

Since this had practically become general international law by 1925, the United States is wrong in claiming today that it is not bound by this ban simply because it never ratified the Geneva Protocol. U.S. soldiers are dangerously misguided by the U.S. Army Field Manual on Land warfare which states in Paragraph 38:

> *"The United States of America are not a party to a valid agreement outlawing or limiting the use of poisonous or non-poisonous gases, of smoke or incendiary matter, or bacteriological warfare. The 1925 Geneva Protocol has not been ratified by the United States and is not binding on this country."*

The United States are, of course, bound by the general ban on poisonous weapons as laid down in Article 23a of the Hague and War Convention which *has* been ratified by the United States. The United States similarly recognized the ban on chemical warfare agents in the 1921 Berlin Agreement whose Article Two makes explicit reference to the relevant provisions of the Treaty of Versailles. What the International Military Tribunal and the American military courts in Nuremberg said of the Hague Land War Convention explains exactly why the rules of the Geneva Protocol *are* binding on the United States. At that time they rejected any discussion on whether the Hague Convention may be applied or not by saying that the Convention expounds the laws and customs of war recognized by every civilized nation. There is no doubt that this is also true of the provisions contained in the Geneva Protocol, which is really nothing more than an elaboration of the arms bans laid down in Articles 22 and 23 of the said Convention.

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[1] Retranslated from German.

Since the ban on the use of chemical and biological weapons is today a generally binding rule in international law—as Resolution 2603 expressly states—those employing such warfare agents or ordering them to be used are guilty of a grave crime and are to be prosecuted in accordance with the Nuremberg principles, even—as one of those principles states—if the laws of their countries should not make them liable to punishment.

Important as these bans are, they do not provide for disarmament. Yet they can make it easier to reach agreements on disarmament. This is emphasized in the UN resolutions 2164 (XXI) and 2289 (XXII). Genuine arms limitations, however, are agreements outlawing nuclear and other weapons of mass destruction—called ABC weapons here—in certain regions. The first agreement of this kind was the Antarctic Agreement of 1959 (Articles One and Five), covering the entire Antarctica. This was followed by an agreement in 1967 on the activities of all states to explore and utilize outer space including the moon and other celestial bodie (the principles of Article Four). Another was the Treaty on the Prohibition of the Emplacement of Nuclear Weapons and Other Weapons of Mass Destruction on the Sea-Bed and the Ocean Floor and in the Subsoil Thereof of 1971 (Article One), convering the high seas. The bans expressed in these agreements covered all weapons of mass destruction—in the case of Antarctica and the celestial bodies other weapons as well—and all states.

A second type of agreements that genuinely restrict armament is represented by the 1968 Treaty on the Non-Proliferation of Nuclear Weapons and agreements on nuclear-weapon-free zones, such as the Tlateloloo agreement of 1967 on the creation of a nuclear-free zone in Latin America, and the 1964 declaration on the creation of a nuclear-free zone in Africa referred to in Resolution 2033 (XX) of 1965, and also the proposals of the People's Republic of Poland to create an atom-weapon-free zone in Europa. The latter proposals were first put forward in 1957 and again in 1962 and 1964 in improved versions; but up till now it has been impossible to implement them because of the resistance of the FRG... The Treaty on the Non-Proliferation of Nuclear Weapons, the agreement on the nuclear-free zone in Latin-America and similar aggreements have one thing in common; they lay down the obligation of non-nuclear countries not to manufacture or otherwise acquire nuclear weapons.

A third type of norm in international law banning the testing, manufacture and possession of ABC weapons is represented by the 1947 Italian, Hungarian, Bulgarian, Rumanian and Finnish peace treaties, and the Austrian State Treaty of 1955. Article 13 of the latter can be considered as the clearest and most up-to-date formula generally valid for the former enemy states. It makes express reference to chemical and biological weapons. The Government of the GDR has on several occasions suggested that this ban, which the Potsdam Agreement and Control Council Act 43 made valid for the FRG and the GDR, be reconfirmed. The most recent occasion was the GDR's draft treaty of 1969 on establishing relations based on equality.

To go ahead with a disarmament agreement on means of mass destruction, for which a remarkable start has been made, the Soviet Union proposed calling either a conference of the five nuclear powers or giving these matters priority at a general World Disarmament Conference. Not only could a meeting of this kind be of importance to a direct restriction or cessation of the nuclear arms race, it could also make an essential contribution to establishment of nuclear-weapon-free zones; this, in turn, would be important both to arms limitation and general international détente.

Another proposal put forward by the Soviet Union and other socialist states is the draft treaty providing for a ban on the development, manufacture and stockpiling and also for the destruction of existing chemical and biological weapons. This proposal was first put before the Twenty-Fourth Session of the United Nations General Assembly and then renewed at its Twenty-Fifth Session. This draft treaty calls for a ban on using these weapons, which already exists in general international law, envisages the destruction of all existing stockpiles as well as a comprehensive ban on their manufacture and development and lays down the obligation not to support or encourage other states to produce such weapons.

Even though these proposals were supported by the overwhelming majority of states they were rejected, in particular, by the United States and Great Britain. Since the latter two could evidently not be persuaded to sign an agreement which, in addition to the Geneva Protocol's ban on using these weapons, would envisage prohibiting their manufacture and stockpiling as well as destroying all existing chemical and biological weapons, the Soviet Union and other socialist states submitted a draft early in 1971 which limited itself to biological weapons in order that progress could be made at least as regards the destruction of biological weapons. Identical drafts to this effect were put before the Geneva Disarmament Committee by the socialist countries and the United States and are now under consideration.

Developments in recent years have shown that in addition to attempts at reaching agreements on banning the production of certain weapons, working out arms limitation agreements could also be a decidedly successful way of realising general disarmament obligations in certain fields which are binding in international law for all states. Such ideas could very well be borne in mind when making preparations for a European security conference.

The Government of the GDR had the following to say on this matter in its message to the Twenty-Fifth Session of the UN General Assembly:

> *"Conditions for regional and world-wide arms limitation and disarmament measures would be markedly improved if the relations among European states with different social systems were to be arranged on the basis of the principles of peaceful coexistence. This is particularly true of the relations between the FRG and the GDR."*

BW-Disarmament: Status and Prognosis

C.-G. Hedén, Sweden

In the eyes of many people, including most scientists, progress in the disarmament field has always been painfully slow, at least in relation to the exponential growth of major world problems both in terms of their size and their associated crisis-frequency. However, there is one field where progress was more than marginal and which might in fact now herald new opportunities for constructive moves. This is the biological weapons (BW) field which is unique in the sense that it will obviously soon provide the first case where Man does away with an existing weapons system. But it might also be the test case for the creativity of statesmen and for the potential of systematic redeployment efforts channelizing military activities towards civilian needs. The latter is a singularly important feature since initiatives to abolish complex military structures will probably always tend to align various biased interests into an overwhelming opposing force as long as there are no alternative endeavours capable of diverting the industrial potential and of creating a very strong sense of relevance.

Biological warfare has drifted in and out of the focus of disarmament attention ever since 1925 when the Geneva Protocol outlawed its use. One reason has been the many reservations, and another the fact that the Protocol permitted retaliation and did not limit research, development and stockpiling. The current surge of attention at the UN Disarmament Committee in Geneva derives its momentum from two intergovernmental and two non-governmental studies as well as from intense public attention reflected in numerous books, conferences and teach-ins. Some highlights were the report of the UN Secretary General (July 1969)[1], the report of the WHO (November 1969)[2], the SIPRI CBW-studies and associated symposia (in progress since 1968)[3] and the study made and resolution passed by the International Congress for Microbiology (Mexico City, August 1970).[4] Such intergovernmental and transnational activities were supplemented by national studies, the most notable ones of which were those performed in the United States. On November 25th, 1969, the latter led President Nixon to announce a unilateral renounciation of biological warfare. This pledge to abstain from the development efforts and to destroy existing stockpiles was initially obscure with regard to toxins. A few months later, however, this group of agents was included in the renunciation. Recently (Sept. 22, 1971) the French Government also made an important unilateral B-renunciation move in that the foreign minister announced a law which would be put before the Parliament during its coming session.[5]

The American initiative stimulated the Geneva discussions which crystallized around various draft treaty texts. The United Kingdom made one proposal which was supported by the United States, but also Sweden, the USSR and the East European communist countries made proposals for possible consideration in the arms control negotiations. The problems of inspection and control as well as the debate about the pros and cons for a split between B and C weapons however led to a deadlock which was not broken until the spring of 1971, when it was the turn of the Soviet Union and other socialist countries to make a constructive move.[6] In August 1971 the socialist countries and the United States were ready to propose identical treaty texts coming relatively close to the initial draft submitted by the UK.

It is now expected that a revised draft treaty, proposed by Bulgaria, Canada, Czechoslovakia, Hungary, Italy, Mongolia, Netherlands, Poland, Romania, Union of Soviet Socialist Republics, United Kingdom and United States of America on September 28th, 1971, will soon be considered by the UN General Assembly and ratified by a majority of nations.[7]...

The potential impact of applied microbiology has been thoroughly discussed elsewhere, [8] [9] [10] but a brief reminder of its relevance to developing countries might still be in order. This will be provided in terms of the environmental issues, the protein gap and the public health aspects.

A rapidly expanding agriculture involves a strain on the nitrogen supply, so that the energy and material requirements of the fertilizer industry easily become limiting factors. The use of nitrogen fixing microorganisms may then constitute an important supplement. Agricultural microbiology also outlines how recirculation can be optimized and how perishable materials can be preserved by fermentation techniques. The green revolutions has generated optimism in many quarters, but it has also opened the gate to a fool's paradise as long as we choose to forget that breeding pest resistance into the new varieties is a slow process. The monoculture crops must obviously be grown under a chemical umbrella which the global environmental concern now makes increasingly unattractive. Fortunately however applied biology is coming to the rescue in the shape of many biological control techniques drawing on developments in the BW-field. The dispersion of male sterilized insects from aeroplanes and the use of microencapsulated bacteria and viruses infecting various pests provide a few examples.

The detection of pesticide residues is not only a public health matter but may also have positive trade effects in the form of certified pestfree vegetables and atoxic fodder proteins. A duty exception for peanuts from a developing country may, for instance, be of little value as long as non-tariff barriers against aflatoxin are established which the exporting country is not able to climb. Aid aimed at improved control techniques may obviously become of great importance, and the same is true for guidance with regard to microbiological recirculation technology (water- and sewage microbiology, composting and other types of organic waste utilization).

Having an abundance of sunlight and an urbanization-related concentration of organic waste materials, the potential of fodder production on the basis of algae should for instance be considerable in the developing countries. With regard to the protein gap the recent rapid strides in single-cell production from oil should also be remembered as well as the established use of microorganisms for producing essential aminoacids and vitamins to improve food quality. Few people however seem to realize that only the most readily available microbiological "resources" have so far been mobilized, and that applied microbial genetics and molecular biology might actually provide keys to a very significant improvement of man's lot. In this connection one of the most important factors may be the fact that the oil industry is rapidly becoming "microbiological". This means that it may consciously or subconsciously be preparing the petrochemical industry for a shift from catalysis, high temperatures and high pressures to enzyme technology operating at the environmental conditions and with the economy characteristic of a living cell. The insolubilized enzyme technology will have a great impact because it tends to economize the enzymes both with regard to the quantities needed and with regard to the longevity of their performance. Alfready now it is feasible to achieve many breakdown reactions, as for instance, the selective removal of some important water pollutants, but experiments are already in progress on such a futuristic multistage synthetic process as the conversion of carbon dioxide to glucose.

The fermentations required to produce enzymes are not too different from the well-established processes used to make antibiotics and other microbial products. Everyone knows what this type of technology has meant to public health and to medicine. However, microbiology has also profoundly influenced the same two fields with a host of vaccines. They have not only improved Man's health but also his opportunities for travelling all over the globe. Perhaps the most significant human vaccines have already been developed, but particularly in the virus field increased offorts may still yield very significant results, for instance hepatitis and cancer vacines. Also the impact of veterinary vaccines development on the protein production in developing countries must not be forgotten: for Latin America the value of the protein losses caused by foot- and mouth disease virus have for instance been estimated to be 600 mill. US $/year.[11]

A network of coordinated laboratories, similar to the already existing International Organization for Biotechnology and Bioengineering (IOBB), would have a double function. First it would focus attention on significant fields and, second, it would help to pool resources which are presently inadequate.

If one, for instance, looks at the problems of microbial process optimization there is at present no laboratory in the world which has sufficient facilities for this task. It would be necessary to have facilities for the selection and identification of microorganisms from natural sources. Then there would have to be possibilities not only for strain improvement by automatic selection but also for advanced genetic techniques. These efforts would then have to be coupled with a physiological optimization and this would provide the basis for computer-aided fermentations aimed both at mathematical modelling and at feed-back control. Finally there would have to be advanced facilities for optimization of product isolation and purification. Many laboratories have several of these facilities but none is capable of launching the whole range of techniques on a single microbial process. Even when that stage is reached we still have a very long way ahead until we can imitate the complex mixed fermentations which are so significant in nature.[12]

A redeployment of military microbiology towards civilian needs obviously offers unique opportunities to mobilize large numbers of competent personnel and to channel great resources towards such fields as were indicated in 1970 by the 10th International Congress for Microbiology:

Applied environmental microbiology
Biogeochemical transformations
Conservation of soils
Crop productivity and biological nitrogen fixation
Production of proteins and other food substances
Production of enzymes and hormones
Purification and recycling of sewage for drinking water
Rapid diagnosis of infectious diseases
Improved means of mass-vaccination
Problems of viral carcinogenis
Problems of molecular biology
Microbiological pest control etc.

Against this background it is of considerable interest whether the international scene can provide a suitable setting for such a change. Two major driving forces can then be distinguished. One derives from the draft treaty mentioned earlier, in particular Article X 61) in the NATO/Warsaw Pact countries draft resolution:[7]

> *"The States Parties to the Convention undertake to facilitate, and have the right to participate in, the fullest possible exchange of equipment, materials and scientific and technological information for the use of bacteriological (biological) agents and toxins for peaceful purposes. Parties to the Convention in a position to do so shall also co-operate in contributing individually or together with other states or international organizations to the further development and application of scientific discoveries in the field of bacteriology (biology) for prevention of disease, or for other peaceful purposes."*

This must be understood as a commitment of governments to foster international co-operation in microbiology. The text further indicates that such efforts will be evaluated five years after the entry into force of the Convention, Article XII reads:

> *"Five years after the entry into force of this Convention, or earlier if it is requested by a majority of Parties to the Convention by submitting a proposal to this effect to the Deposition Governments, a conference of States Parties*

> *to the Convention shall be held at Geneva, Switzerland, to review the operation of this Convention, with a view to assuring that the purposes of the preamble and the provisions of the Convention including the provisions concerning negotiations on chemical weapons, are being realized. Such review shall take into account any new scientific and technological developments relevant to this Convention."*

We can obviously predict efforts both on the part of governments and on the part of the specialized agencies in preparation for a "Microbiology and Chemistry for Peace" conference in Geneva 1976 or 1977. To governments with large-scale efforts in military microbiology redeployment might then seem to be a very logical proposal. In fact, we had such an idea at least since 1962 when it was voiced at. The "Woods Hole Summer Study of Verification and Response in Disarmament Agreements"[13]...

The second driving force for systematic international efforts in microbiology is that such efforts would serve as a natural basis for an extensive fellowship exchange programme. This might help to reduce the anxiety felt in many quarters of the world both with regard to the lack of provisions for inspection and control in the new draft treat and with regard to the problems of drawing a line between offensive research and development on the one hand and defensive activities on the other.

A laboratory network, associated or not with the WHO, would provide the basis for a fellowship exchange programme but it would also make the complaints procedure, proposed in the new draft treaty, a bit more workable than at present. For instance, how will it be possible for anybody to collect evidence if no reporting of data is provided for? In the convention no fact–finding machinery is envisaged to deal with the complaints before their submission to the Security Council. Thus there is a grave risk that allegations might become a matter of political controversy and this might cause such serious delays in the appointment of expert teams etc. that fact-finding would become jeopardized.

The world's 60,000 microbiologists are also well organized within the framework of the International Association of Microbiological Societies (IAMS) with its numerous specialized committees and sections. Even at the level of the Specialized UN-Agencies there is an informal structure for co-ordinating the various microbiology programmes. This initiative, which was taken by the UNESCO/ICRO Microbiology Panel, now provides a planning platform for the International Conferences on Global Impacts of Applied Microbiology,[8] [9] [10] which are especially devoted to the discussion on problems and resources of the developing countries.

At the last meeting (Sept. 13–14, 1971) of the interagency microbiology group (which involved participation from UNESCO, WHO, IAEA and FAO besides IAMS, WFCC, IOBB, ICRO and IUPAC), the implications of the CCD Draft Treaty were discussed as well as the problems associated with the establishment of a new International University structure. The latter question is highly relevant to any plans for international laboratory networks. It is currently studied by a Panel of Experts set up under UN General Assembly resolution 2691 (XXV) for the purpose of assisting the Secretary-General in his further consultations and studies on this question. At its first session in July 1971 the experts stressed the need for interdisciplinary studies on a multi-ideological basis and from a truly global rather than a national point of view, of major issues before the United Nations (peace-keeping, arms control and disarmament, human rights, development and use of natural resources, the world trade system, the sea, peaceful use of outer space, transfer of science and technology, protection of the environment, population, social anthropology or cross-cultural studies)... Stimulating the thinking and efforts of institutions of higher learning towards the UN Charter objectives would be one of the major functions of a post-graduate international university, primarily concerned with research...

An important contribution to the current UN discussions on contacts, coordination and collaboration among "Institutions for Development" was made by a workshop on this topic, held in Bellagio under the auspices of the Nobel- and Rockefeller Foundations from October 11–16. Besides considering the proposed international UN-university, etc., the group also discussed the implications of the draft treaty on disarmament in the field of biological warfare. It expressed the hope that

> *"the Nations would not fail to seize the opportunity, at the current UN General Assembly, to advocate a redeployment of the facilities for military microbiology towards civil functions. If those facilities could form part of a laboratory network for international collaboration in applied microbiology a very significant activity would be added to the general efforts which further the development process".*

As indicated by the foregoing discussion there seems to be a fair chance that various efforts focused on the solving of global problems, particularly in the developing parts of the would, may well become coordinated under a common heading. This ought to attract much attention among decision makers in developing countries who should have a particular interest in strengthening the efforts within applied microbiology. Even today, some of them might think of biological weapons in terms of the old cliché: "The Poor Man's Deterrent", but the perspective of the gains which are now within reach of well co-ordinated international research efforts, should outweigh the wish to consider such military options.

The chances for universal acceptances of the B-Treaty as well as general adherence to the Geneva Protocol would thus be increased. In spite of the increased number of ratifications in recent years the Protocol still lacks some forty signatories. In the context of rapid progress in the "disarmament through redeployment"-moves it seems essential that those ratifications, in particular that of the USA, are made without reservations.

To sum up: B-disarmament is within reach and the stage is set for international cooperation in microbiology. This could have a profound effect on the development process in the poor countries and might trigger "disarmament by redeployment" initiatives in other fields.

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The Struggle of the Socialist States for a European Security Conference

G. Heidorn, GDR

It would by no means be exaggerating if, surveying the events of the past weeks, one reached the conclusion that Europe had again made considerable progress along the road to a Security Conference. Nevertheless, the difficulties facing such a conference cannot be overlocked. To overcome these difficulties requires great efforts on the part of the different peoples and governments. The session of the nuclear planning group of the North Atlantic Treaty, for example, which recently met in Brussels towards the end of October 1971, obviously worked with old manuscripts originating from the period of the cold war and was not ashamed to speak forebodingly about the danger of a Soviet attack on Western Europe. We have no reason to underestimate those opposing a relaxation of tension in Europe and the world, no matter whether they sit in the West German CDU/CSU, in Downing Street, in the Pentagon, or elsewhere.

In order that the problem might be understood more clearly, I would like to point out a few facts and conceptions connected with the problem of European security. First it should be noted that the struggle of the socialist countries and other forces for European security goes back much further than our efforts for a conference. I would like to point out in this connection that the German Democratic Republic has spared no efforts since its foundation, together with the Soviet Union and the other socialist countries, to make sure that imperialist aggression should never again start from German soil as has happened twice within half a century. Further, it may be sufficient to note that the GDR as a member state of the Warsaw Defence Alliance has actively worked from the very beginning for European security and a conference serving this purpose. We, together with our friends, have always been concerned with the whole of Europe and not only with parts of that continent. I emphasize this because the term Europe today is very often presumptuously misused for parts of it. Neither do I need to prove that the community of the Six, even if it were to be increased to ben, nor the so-called Council of Europe ever were, or are, the representatives of Europe in terms of the political, economic, cultural, military and geographical realities. Therefore, I would first of all like to establish the thesis that the edifice of European security cannot rest on the principle of maintaining or even intensifying a political and military confrontation.

But we cannot ignore the facts as they stand that two military coalitions face each other in Europe at present. Let us for now pass over the causes of this. These facts directly affect developments in the rest of the world, for our continent, although its area is only six per cent of that of the earth, nevertheless has a mighty industrial potential and contributes more than half of the world's industrial production. Although it would be most alluring, I shall not speak about the way in which many ideas of progress and social justice have a made lasting impression in Europe. The classical bourgeois revolutions took place here, the first socialist revolution was led to victory here by the Russian proletariat, an event which the great Frenchman Romain Rolland described as "a mighty effort on the part of old Europe to create a new world". If I speak here of the historic achievements and industrial resources of Europe I by no means wish to advocate Euro-centrism as has for so long been characteristic of many works of bourgeois histiography and which is also still to be found in some modern history books.

Europe is not the centre of the world, European history was never world history and European politics were and are not world politics. Nevertheless the influence of developments in Europe was and is, of course, significant and its problems naturally affect the whole world, especially since nowadays on its soil two diametrically opposed social orders, imperialism and socialism, highly organized politically and militarily, find themselves face to face in a confrontation which has lasted for some time. The community of socialist states which has provided the foundations for its political and military coalition in the Warsaw Treaty and for its economic, scientific and technical cooperation in the Council for Mutual Economic Assistance, makes a very important contribution to the growing political, economic and military potential of the entire world socialist system and has already brought about, it can be stated quite objectively, a constant change in the relation of forces in the world arena in favour of socialism...

Above all in Europe the strongest military groupings in human history find themselves face to face. The frontier between the two German states is at the same time the border between the military coalitions mentioned above, and it cannot be overlooked that the West German Bundeswehr represents the strongest European contingent of troops within the NATO.

The struggle for world peace and, in this connction, for a policy of European security based on peaceful coexistence between countries with different social systems, is an essential attribute of socialist foreign policy. This policy is rooted in the social foundations of the socialist states... It is not difficult to discern the continuous thread of Soviet foreign policy from the decree on peace in 1917, the Treaty of Rapallo in 1922, the struggle for a system of collective security in the period between the two world wars, the struggle at the head of the anti-Hitler coalition during the Second World War to the peace program of the 24th Congress of the CPSU. This thread has been the determining factor in the foreign policy of all members of the community of socialist states.

Thus it was the 24th Congress of the CPSU in particular which, in 1971, presented a pogram for the consolidation of peace. Eight concrete problems can be perceived in this program:

1. Renunciation of the use of force and the threat of the use of force in settling disputes;
2. Recognition, once and for all, of the territorial changes which came about in Europe as a result of the Second World War;
3. Simultaneous annulment of the North Atlantic Treaty and the Warsaw Treaty, or, as the first possible step, the liquidation of their military organizations;
4. Cessation of the arms race in all fields, especially nuclear armament, by all states which are in possession of nuclear weapons and the establishment of nuclear-weaponfree zones in various regions of the world, including Europe;
5. Reduction of the armed forces and arms in regions of the world where the danger of military confrontation is especially great, as in Central Europe;
6. General reduction in military expenditure, especially that of the Great Powers;
7. Formulation of measures to prevent the probability of accidental or intentional outbreaks of military incidents and their expansion into international crises or even war, as was begun in the negotiations between the USSR and the USA in Helsinki;
8. Deepening the relations of mutually beneficial cooperation in various fields. Such problems would include questions of environmental protection, the opening up of power and other natural resources, the development of transport and communications, research into and the opening up of outer space as well as the world's oceans, etc.

Without the persistent struggle of the community of socialist states, the situation would not have matured to the point where the convocation of a European security conference is no longer improbable. The proposals put forward by the socialist countries can be precisely retraced. They were not made all at the same time but over a period of five years. They were expressed at the conferences of the states of the Warsaw Treaty in Bucharest in 1966, in Budapest in 1969 and in Berlin in 1970 as well as at the meetings of the foreign ministers of these countries in Prague (1969), Budapest (1970) and Bucharest (1971). The foreign ministers could rightly declare in Bucharest in February 1971 that, thanks to the efforts of the socialist and other countries, certain tangible advances had been made in the policy of easing tension on the European continent. Therefore, it is now a question of proceeding from the preparations for, to actually holding, an all-European conference on questions of security and cooperation on a multilateral basis... The GDR has unmistakably declared that it will work with all the means at its command for the following principles:

1. It supports the summoning of a European security conference and is ready to take a constructive part in it on the basis of equality;
2. It declares its readiness to become a member of the United Nations and its specialized agencies
3. It is ready and willing to establish normal diplomatic relations with all countries;

4. It is also ready to enter into normal diplomatic relations on the basis of international law with the Federal Republic of Germany;
5. It seeks, in the spirit of the Quadripartite Agreement between the USSR, France, Great Britain and the USA of 3 September 1971, to normalize relations with West Berlin in order to contribute to relaxing tension in the centre of Europe...

The problem of the agenda understandably plays an important role in international discussions. We are all agreed that it is meaningful to discuss questions at the conference which are ready for solving and which are of all-European interest... Naturally the opponents of a relaxation in tension have adopted their counter-measures and are not ready to give up. At the Brussels NATO Council session in December 1970 US Secretary of State, Rogers, declared that his government was against multilateral contacts between NATO countries and socialist states. And in order to place obstacles in the way of the calling of a European security conference, certain circles like to make use of the tactics of laying down prior conditions.

Unlawful package deals are not suited to paving the way to further detente in Europe. The same is true of the attempts to alter the character of the conference by putting forward unsuitable points for the agenda and thus condemning it to failure from the very beginning. Thus, for example, negotiations about a possible reduction in troops could be conducted only as a result of a positive conference. Many problems awaiting solution need parallel negotiations. What we now need is a climate favourable to the aims of the conference. Happily, it can be seen to what extent the idea of a security conference has gained a foothold among the people, many parties and organizations and also the governments of various countries...

Numerous scientists from various countries agree with the broad organizations of the working class in the efforts for peace and security in Europe. The World Federation of Scientific Workers can claim to have supported very early and very consistently all conceptions and proposals on this subject in complete agreement with its principles. Now the circle of those who agree with us on this basic concern has expanded. The calling of a European security conference in 1972 has entered the realm of distinct possibilities. It will not put an end to the historic struggle between socialism and imperialism. But the implementation of the principles of peaceful coexistence as a real force in international politics, and the further regrouping of political tendencies in the international arena in favour of peace, for which the community of socialist states is striving, can in many respects be decisive in determining how relations between the European countries will look in the future.

Problems of ABC Weapons from the Point of View of International Law

K. Ipsen, FRG

International law deals with ABC weapons in *two fields of regulation,* which despite many interrelations are to be systematically distinguished from each other.

Prohibitions in international law of the development and production, the dissemination and possession of ABC weapons as well as contractually fixed control mechanisms for the maintenance of such prohibitions are classified under the *law on the prevention of war,* whose range extends from the basic prohibition of the use and threat of force, the commandment to settle disputes peacefully to the constantly growing mass of contractually agreed upon disarmament, arms limitations and arms control.

Prohibitions in international law of the use of ABC weapons, on the other hand, come under the *law of war,* according to the rules of which the legality or illegality of the conduct of war in an armed conflict of an international character which has once broken out is determined and thus also the legal or illegal use of weapons.

The law on the prevention of war and the law of war–like international law in general–know three types of legal norms: the law of treaties, common law and generally recognized legal principles. As far as the law on the prevention of war provides regulations concerning ABC weapons it has up to now appeared exclusively as a treaty partner. The law of war, in contrast, contains both treaty and common law rules as well as generally recognized legal principles which have application to ABC weapons.

In the following the essential legal regulations of valid international law in the field of the law on the prevention of war and the law of war will be briefly presented as far as these fields of law involve ABC weapons. Here it must be pointed out each time whether it is a question of treaty law, common law or generally recognized principles of law. Moreover, it will be necessary to distinguish between principles of international law with a claim to universal or to regional validity.

I. The Law on the Prevention of War

In the course of the last decade a number of treaties have been negotiated, signed and come into force which contain single measures in the field of disarmament or arms control with respect to ABC weapons.

First, concerning A weapons, two treaties with a universal claim to validity should be mentioned:

1. The *Test Ban Treaty* of 5 August 1963 in force since 10 October 1963. This treaty adopted by the signing or accession of 116 states prohibits the testing of nuclear weapons in the atmosphere, outer space and under water. All nuclear or potential nuclear powers have joined the treaty except France and the People's Republic of China.
2. *The Treaty on the Non-Proliferation of Nuclear Weapons* of 1 July 1968, in force since 5 March 1970. When it came into force 98 states had signed the treaty and 46 states had ratified it. Up to now France and the People's Republic of China have made no attempt to accede to the treaty. This treaty represents the most significant progress made up to now in the field of the law on the prevention of war with respect to A weapons...
3. The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies of 27 January 1967, which came into force on 10 October 1967 after ratification by Great Britain, the Soviet Union and the United States, also belongs to the law on the prevention of war, but in constrast to the two above-named treaties includes all types of weapons of mass destruction. This treaty, access to which is open to all states, especially prohibits the stationing of nuclear weapons and all other weapons of mass destruction in orbit around the earth or in any other way in outer space as well as any military use of celestial bodies outside the earth.
4. An essential individual measure for preventing a nuclear war by accident is represented by the *Agreement on Measures to Reduce the Risk of Outbreak of Nuclear War and to Improve the Direct Telephone Communications Link* signed on 30 September 1971 by the foreign ministers of the Soviet Union and the United States that came into force upon signature. This agreement is to prevent false interpretations with reference to nuclear accidents by means of technical precautions and to enable the highest degree of exchange of information between the two largest nuclear powers...
5. Although only of regional importance but at the same time interesting from the aspect of its model character is the *Treaty for the Prohibition of Nuclear Weapons in Latin America* of 14 February 1967. It went into force in June 1969 and at present is valid for 17 of the 22 signatory states. By this treaty the Latin American subcontinent became a nuclear-weapon-free zone. Cuba is the only Latin American country which has postponed signing the treaty until the US bases in Panama, Puerto Rico and Guantanamo are abolished.
6. A further nuclear-weapon-free zone, immediately to the south of the Latin American zone, was created by the *Antarctic Treaty* of 1 December 1959. It went into force among 13 states on 23 June 1961. This treaty in addition to its reference to nuclear weapons guarantees that Antarctica as a whole is treated as a demilitarized zone.
7. Finally, in connection with the valid treaties of the law on the prevention of

war with reference to ABC weapons the regional *Treaty of the West European Union* of 1954 is to be mentioned. This treaty contains a renunciation valid in international law of the production of ABC weapons by the Federal Republic of Germany, a definition of these weapons, which comprehensively includes all present and possible future ABC weapons as well as an international control system which ensures the observance of the treaty obligations.

II. The Law of War

The law of war which determines the legality or illegality of the use of certain means of warfare in an armed conflict contains a number of legal principles which are applicable to ABC weapons.

In part these legal principles deal solely with the *effect of weapons.* Thus the Hague Convention of 1907 respecting the Laws and Customs of War on Land which by now is widely recognized as common law contains a number of provisions out of which arise prohibitions of use because of the effect of the weapons: the general clause of Article 22 first states generally that those conducting war have no unlimited right in the selection of means for injuring the enemy. Making this clause more concrete Article 23b prohibits the treacherous killing or wounding of the opponent, and Article 23e prohibits the use of weapons, projectiles or substances which are able to cause unnecessary suffering. Article 25 prohibits "attacking or firing on undefended cities, villages, residential areas or buildings with whatever means"[1] and thus fixes the principle of the protection of the civil population. This principle–although repeatedly violated–belongs to the generally recognized principles of the law of war. The distinction between combatants and neutrals in war actions, which in particular with the use of A and B weapons is not guaranteed, likewise belongs to these generally recognized principles...

Consequently a prohibition based on the *type of weapons* is more effective, for it excludes to a far-reaching extent the removal of certain types of ABC weapons by means of a restrictive interpretation. Such a prohibition of use oriented on the type of weapon is contained in the Geneva Protocol on the Prohibition of the Use of Asphyxiating, Poisonous or other Gases as well as Bacteriological Methods of Warfare of 17 June 1925, which in the meantime has been acceded to by 96 states, including all important industrial countries with the exception of the United States. The broad wording of the Geneva Protocol with reference to C weapons covers, beginning with irritants which only lead to incapacity to fight, all types of chemical warfare agents. The extension to non-lethal C agents, especially to tear gas, is disputed from the American side. In this it is constantly overlooked that the United States itself was one of the authors of the formulation of the C weapon prohibition contained in the Geneva Protocol: the Geneva Arms Trade Conference of 1925, the result of which was the abovementioned Protocol, took over expressly and word for word the prohibiting formula of the Washington

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[1] Retranslated from German.

Treaty concerning the use of submarines and poison gases in war of 6 February 1922, which was signed by the United States but not ratified. The preparatory work on this treaty to which the Geneva Arms Trade Conference also referred, clearly shows, however, that the formula which later went into the Geneva Protocol was selected in order to prohibit chemical warfare "in every form and against every object" (Conference on the Limitation of Armament, Washington, 1922, 16th session, Protocol p. 736). Tear gas was also expressly included. Also the treaty formula was to be suited for including all future developments in the field of C weapons in order to remove the basis from the very beginning for the argument about the "newness" of a weapon, frequently used to defend chemical warfare agents developed later against the validity of the prohibition of use in the law of war. In the present discussion of international law the reciprocal relation between the Washington Treaty and its preparatory work and the Geneva Protocol is completely disregarded. The Geneva Arms Trade Conference, however, deliberately took over the formula of that treaty with the content, as it was fixed in Washington after detailed negotations. In view of this state of affairs and legal situation the Geneva Protocol prohibits every kind of chemical warfare. As to B weapons it is recognized today that the Geneva Protocol prohibits not only the use of bacteriological warfare agents but in general all military use of microorganisms or their toxic products. Political statements on the B weapon problem up to now have aimed at keeping the option to use new weapons which are not yet operational open by considering them as not yet having been legally included. In doing so it is overlooked that from the standpoint of international law the law of war–whether fixed by treaty or by common law–represents the only yardstick by which the conduct of war and also the use of new weapons is to be measured. Here the order function of the law of war becomes clear. It alone sets forth the postulated behaviour according to which the actual behaviour of those conducting war is assessed. It follows from this that the law of war can also ban weapons and methods which were not known at the time it came into existence.

Thus, the prohibition based on the type of weapon of the Geneva Protocol of 1925 embraces *all* chemical and biological warfare agents. The only exception is the reprisal, that is the use of BC weapons against an aggressor who was the first to use these weapons in violation of the ban. Therefore, it is correct to speak of the *prohibition of the first use* of BC weapons.

In conclusion, with reference to the valid law of war, it should be stated in general that, as far as the use of nuclear weapons is concerned, there are prohibitions only of the effect of the weapon. These prohibitions offer, as has been clearly shown with the examples of psychochemical warfare agents and tactical nuclear weapons, no sufficient security that ABC weapons will not be employed in an armed conflict. On the other hand the more effective instrument from the point of view of international law against such use is the prohibition of the first use because it is sufficiently unambiguous. The inclusion of A weapons in this prohibition should also be striven for.

Trends in the Pre-legal Stage

Only two treaties will be pointed out which, already signed but not yet in force, nevertheless represent a considerable progress in disarmament relations with reference to weapons of mass extermination.

The Treaty on the Prohibition of the Emplacement of Nuclear Weapons and Other Weapons of Mass Destruction on the Sea-Bed and the Ocean Floor and in the Subsoil Thereof of 11 February 1971. This treaty goes into force after the ratification documents have been deposited by 22 states. It represents, as it were, the counterpart to the above described Outer Space Treaty which is already in force. Both treaties ensure that two of the most important spheres for the future of mankind – outer space and the ocean – are to be kept free of weapons of mass extermination.

On 5 August 1971 the Soviet Union and the United States jointly submitted to the Geneva conference of the Disarmament Commission a *Draft Convention on the Prohibition of the Development, Production and Stockpiling of Chemical and Bacteriological (Biological) Weapons and on the Destruction of such Weapons.* This convention which should be valid law in the near future goss beyond the Non-Proliferation Treaty in objective and importance as it legally ensures that the most threatening kinds of warfare agents for mankind will be eliminated from the arsenals of all countries.

The two above-mentioned instruments at the same time indicate the most important trends which should be followed in the field of disarmament ensured in international law, namely, the weapon-free zone and the absolute ban on production and possession with reference to weapons of mass destruction and their complete elimination.

The Tasks of the Future

Valid law with reference to ABC weapons in the field of the law on the prevention of war and the law of war as well as the main trends in the pre-legal stage allow one to ascertain, in conclusion, what loopholes should be closed in the future through international treaties. The following lists only those spheres in which in view of previous negotiations and drafts there is at least a certain prospect of bringing about a regulation.

As to A Weapons international efforts should primarily concentrate on three objectives:

1. Negotiation of a draft convention on the *prohibition of the first use of every type of nuclear weapon.* This proposal has already been introduced in the Geneva disarmament discussion by the Soviet Union and has been followed for a considerable time. Should the main powers of the Geneva Conference of the Disarmament Commission or the countries participating in a conference of nuclear powers suggested by the Soviet Union, be able to agree on such a draft convention then it might be possible to obtain in the sector of A weapons what has already been reached for BC weapons in the Geneva Protocol of 1925: An absolute prohibition of first use contained in the law of

war based on the *type of weapon* and therefore making the first use of nuclear weapons in case of an armed conflict illegal in international law.

2. Continued investigation of the possibility of establishing further *nuclear-weapon-free zones.* Proposals for Central Europe and the African continent have been made. But in both geographical regions there are still numerous opposing conceptions of this disarmament measure which it will take lengthy negotiations to bridge over.
3. Continuation of the negotiations on a *comprehensive test ban.*

The next goal with reference to *B weapons* should be the signature and ratification of the American-Soviet draft treaty of 5 August 1971 and the strict enforcement of the treaty after it has come into force. Every state should be clear about the importance of the attempt undertaken with this treaty: if this attempt fails the international disarmament efforts made up to then would suffer an almost irreparable reverse.

The Draft Treaty of 5 August 1971 envisages in Article 11 after five or less years negotiations on a similiar prohibition of the development, production and possession of *chemical weapons.* Insofar as a compromise for this category of weapons of mass extermination can also be obtained, the law on the prevention of war, with the treaty on the nonproliferation of nuclear weapons, the convention on the prohibition of the production and possession of B weapons and the same type of convention on C weapons would be a respectable set of instruments suitable for considerably lessening the threat to mankind from weapons of mass extermination.

The Prohibition of the First Use of ABC Weapons as a Part of the Minimum Standard of International Law

The regulations of the law of war up to now have extended, so far as a prohibition of the first use of weapons of mass extermination is contained, to war between states or groups of states, on the other hand, to an armed conflict between a legitimate state leadership and rebels who are not recognized as a war-conducting party. It should therefore be a task of the future to add the existing prohibition of the first use of BC weapons and–insofar as attainable–the prohibition of the first use of A weapons based on the type of weapon to the minimum standard of the humanitarian law of war, which should also be respected in a civil war situation.

The GDR and its Attitude towards the Prohibition of BC Weapons

W. Krutzsch, GDR

The GDR advocates the limitation of the arms race as well as world-wide and regional disarmament. Its efforts for universal and complete disarmament are a basic constitutional principle of its foreign policy. The GDR's special attention is focused on arms limitation and disarmament in the field of weapons of mass destruction. These weapons constitute a particular threat to peace; their possible use implies immense hazards, in particular for those in heavily populated areas of Europe. At the same time, steps towards partial disarmament in this field will most effectively pave the way for more comprehensive disarmament measures that will serve the ultimate aim, i. e., universal and complete disarmament.

The GDR is a party to all existing treaties on arms limitation covering all weapons of mass destruction. It was among the first states to sign and ratify these treaties. Proceeding from its general attitude towards disarmament in the field of weapons of mass destruction, the GDR has expressed itself in several declarations in favour of prohibiting all weapons of this kind (chemical and bacteriological/biological ones), and for destroying all their stockpiles. It has also constructively worked towards concluding agreements in international law to this effect...

In its support of a comprehensive ban on all CB weapons the GDR is guided by the endeavour to strengthen the Geneva Protocol of 1925, which prohibits the *use* of all CB weapons, and to ensure its world-wide validity. The GDR is a party to this Protocol. It emphatically supports Resolution 2603 (XXIV) of the UN General Assembly which states that the ban on using chemical and biological weapons in international armed conflicts constitutes a generally recognized rule of international law, embodied particularly in tne Geneva Protocol. The GDR emphatically supports the demand that all states ratify and strictly abide by the Geneva Protocol. It has repeatedly and energetically condemned the use of chemical weapons, such as herbicides and tear gas, in the USA's aggressive war against the peoples of Indochina since this use is contrary to international law.

In view of the fact that an agreement on the prohibition of B weapons may now be expected, the task of prohibiting C weapons as well gains priority in the endeavours in this field. The GDR statement to the 26th UN General Assembly on questions of disarmament and arms limitation says:

> *"The German Democratic Republic emphasizes its determination to continue to support the prohibition of chemical weapons of mass destruction as well. The consequences which a war waged with chemical weapons involves for and mainly for the civil population in the congested areas of Europe, alone the hazards that arise from stockpiling such weapons within this area, make their liquidation one of humanity's most urgent demands."*

The convention banning B weapons might serve as a starting-point and a basis for this purpose. I am thinking, in particular, of Article IX of the draft convention on the prohibition of bacteriological (biological) weapons and toxins. This Article says that every state which is a party to the convention confirms the approved aim of effectively prohibiting chemical weapons. At the same time each signatory state engages to conduct negotiations in good faith with the aim of arriving at a ban on C weapons. If this draft convention banning C weapons should come into force, this would be one more guarantee that the discussions on prohibiting chemical weapons remain on the agenda.

Article VIII of the convention prohibiting B weapons refers to the Geneva Protocol of 1925, and stipulates that nothing in the draft convention may be interpreted as limiting in any way whatsoever the Geneva Protocol.

Acceptance of the draft convention prohibiting B weapons cannot but promote the conclusion of a ban on C weapons. If we can succeed in making all nations strictly respect the ban on using such weapons–so that any violation of this prohibition (as by the USA in Vietnam) meets with general international condemnation–then all existing resistance to an agreement on destroying these weapons will be overcome more easily.

Of special interest is also the fact that the draft convention prohibiting B weapons envisages guarantee measures which, if applied properly, might serve as a model for a ban on C weapons: Article IV of the B convention requests every member state to take, in accordance with its particular constitutional procedures, all the measures necessary for abiding by the regulations of the convention. If these obligations are violated provision is made for initiating legal procedures in the UN Security Council against the offending country.

The most important thing about these guarantee regulations is that they increase the responsibility of the convention's member states. They strengthen the confidence among states and peoples, and are based on the interest of all peoples to safeguard peace and security by way of disarmament. If such guarantee regulations were also included in an agreement prohibiting chemical weapons, opponents of disarmament would be deprived of the chance to obstruct agreements on disarmament by making control-inspection demands that are neither substantiated nor realizable in practice, as they have done so far during the efforts to bring about a ban on C weapons.

Indeed, it is detrimental to any increase in the responsibility of states and to further progress towards disarmament if attempts are continued to limit, on the occasion of disarmament agreements, the legal consequences of the GDR's accession to such agreements by including provisos. Thus, when signing the treaty banning the emplacement of weapons of mass destruction on the ocean floor, the FRG officially stated anew that this treaty does not imply any legal relations with the GDR for the FRG. The USA has also made similar statements. Without going into the extremely dubious legal character of such statements, it must be noted that it is by no means beneficial to a climate suitable for disarmament measures and relaxation of tension if certain states even utilize the signing of disarmament agreements in order to discriminate against the GDR.

On the other hand, it should be stressed that United Nations membership of the GDR and the FRG and the establishment of relations with the GDR based on equality and international law will undoubtedly contribute towards improving the climate of detente and understanding in Europe and the world. Such a climate—and there is complete agreement here—will considerably improve the prospects of success in the field of disarmament. The GDR will do all within its power to contribute to such a development.

Social and Economic Consequences of Disarmament

J. Kuczynski, GDR

A great deal has been said and written during the past 15 years about the social and economic consequences of disarmament and rightly so! For the longer arms were maintained at a high level and the more arms expenditure was increased, the heavier was their burden, not only on the national economy and in particular on the budgets of the different countries, but also on the development of science and technology.

When the issue of the moment was the social and economic consequences of disarmament, those saigning for disarmament pointed in particular to the prodigious financial and material burden which armaments constitute. Consequently, it was pointed out how much could be done, for example, for the health service, for education (also in the most advanced countries) and how much could as a whole be done for the developing countries if stocks of arms were dissolved. This was quite correct. Many people became aware of the madness of continuing to arm by visualising the amount of material and spiritual benefits to be won by mankind from disarmament. No country in the world could fail to benefit in this way.

Far less attention has been paid to the consequences of disarmament for science and technology, although the moral position of the scientist helping to create new means of destruction had already been recognized, especially since scientists had occupied themselves most seriously with this question. Neither had the problem been ignored that science and technology had experienced an extraordinary development during the past quarter of a century in connection with weaponry, and the question was also asked whether a similar development would also be possible if armament was replaced by disarmament.

In this contribution to our Conference questions of science will be dealt with in particular, although partly under a somewhat different aspect from that just mentioned.

Let us begin by looking at the consequences of disarmament for production techniques, as the expression of which we shall first take the development of the output per worker per hour, i.e. of labour productivity in industry. Let us examine the situation in the United States, where the highest percentage of the gross national product is spent on arms. Labour productivity there developed as follows:

Increase in output per worker per hour in American industry from decade to decade

Decades	*Increase per cent*	
1900/09–1910/19	21	32
1910/19–1920/29	43	
1920/29–1930/39	33	
1930/39–1940/49	23	27
1940/49–1950/59	27	
1950/59–1960/69	32	

Whereas in the arms industry, considering the range and destructive power of its products per employee and per hour, output increased by thousands and even tens of thousdands of per cent during the past three decades, the increase in productivity in the civilian goods industry, which constitutes over 90 per cent of all industry in the USA, continued, of course, as in the previous 30 years, but at a slower rate than during the first decades of the 20th century. This means that during the years when the USA was arming at a feverish rate these was a restraining, obstructing influence on the development of labour productivity in the civilian goods industry.

Seymour Melan illustrated the technical consequences of arms stockpiling in the USA as follows in his book "Pentagon Capitalism":

1. By 1968, United States industry operated the world's oldest stock of metalworking machinery; 64 per cent was 10 years old and over.
2. No United States railroad has anything in motion that compares with the Japanese and French fast trains.
3. The United States merchant fleet ranks 23rd in age of vessels. In 1966, world average-age of vessels was 17 years, United States 21, Japan 9.
4. While the United States uses the largest number of research scientists and engineers in the world, key United States industries, such as steel and machine tools, are in trouble in domestic markets: in 1967, for the first time, the United States imported more machine tools than it exported.
   As civilain industrial technology deteriorates or fails to advance, productive employment opportunity for Americans diminishes."

Let us now examine this problem at an international level:

Country	*Investment in % of the gross national product, 1960/69*	*Annual % increase in labour productivity, 1965/70*	*Arms expenditure in % of gross national product 1955/70*
USA	13%	2.1%	9%
Britain	14%	3.6%	7%
France	18%	6.6%	5%
FRG	20%	5.3%	4%
Japan	27%	14.2%	1%

Although one has to proceed with all due caution when analysing these figures, what they point to is so obvious that this can be regarded as scientifically proved: In these three groups of countries, those with a very intense rate of armament, such as the USA and Britain, those with a more moderate armament rate such as France and the FRG, and those with a very minimal armament rate such as Japan, we find that the most intense rate of armament led to comparatively low investment and to a comparatively low increase in labour productivity, whereas the countries with a more moderate armament rate also show moderate values in investment and increase in labour productivity, and Japan with a very low armament rate shows an outstandingly high rate of investment and an enormous rise in labour productivity. This means that the more intensely a country concentrates on arming, the more miserable will be the situation for its civilian goods industry.

Armament may, in the short run, lead to relatively low rates of unemployment in the capitalist countries and to flourishing business, and this for two reasons: firstly, because armament brings marginally significant business orders, and secondly, because the slowing down of technological advance means less labour redundancy. In the long run, however, arming will lead to technical backwardness and thus to decreasing ability to compete on the world market and to a general economic deterioration. This is a situation which is nowadays particularly evident in the United States.

Before following up this train of thought it is necessary to give a brief survey of the corresponding situation in the socialist countries. Is the situation fundamentally different? The answer is: yes and no. In the Soviet Union the situation does not fundamentally differ from that existing in the United States in as far as the former also has a very high rate of arms expenditure and by concentrating its research and development on arms exerts a restraining influence on the development of technology in its civilian goods economy. This restraining influence prevails despite the outstandingly important historic and moral fact, that the USA is arming to conquer and dominate the world, whereas the Soviet Union is being forced to arm to defend socialism and its achievements. The restraining influence on technical development in the two countries also shows an interesting and not unimportant difference in trends: although the armament efforts of the Soviet Union are not and must not be less intense than those of the USA, socialist relations of production allow an increase in labour productivity at a faster rate than is possible in America and Britain, an increase approximately equal to that shown by the group of countries in the capitalist world with more moderate armament rates.

Naturally, we in the socialist countries consider such an increase in labour productivity as insufficient. Naturally, we consider that the obstructing influence exerted by arms spending on our ability to raise labour productivity to be a very serious problem. Thus, although the preservation and safeguarding of peace is the primary objective of our efforts for disarmament and security, it should not be overlooked that we also bear in mind the possible effects which disarmament would have on raising technical standards in our industry, agriculture and infra-structure.

The effects of arms spending on the general condition of the economy, however, are fundamentally different in the capitalist and socialist countries. The economic malaise caused in the United States by arms expenditure is not to be found in the Soviet Union. On the contrary, the economy of the socialist countries, in particular that of the Soviet Union, is nowadays flourishing on a sounder basis than ever before.

In this connection, I would like to recall a twofold experience which I had with the recently deceased John Desmond Bernal, an outstanding scientist and fighter for peace, a man who supported our struggle right up to the last day of his so abundantly active life, and who frequently played a leading part in our efforts. During the Second World War we had met from time to time. We also met after the war–for the last time in Moscow, where Bernal related to me the following interesting story. His American war-time acquaintances, whom he had met when dedicating his scientific knowledge to the struggle against Hitler-fascism, included several people who subsequently came to occupy important positions in the Pentagon. When the war was over he still used to speak to the one or other of them and more often than not they touched upon the question of arms escalation throughout the world. On one occasion Bernal asked why the USA constantly continued to arm when it already had enough arms to annihilate mankind, thereby forcing the Soviet Union to strengthen in return her defence measures. "You've hit upon the right word there–force them. That's exactly what we want", was what his Pentagon acquaintance replied, giving the following explanation:

> *"You see, it's becoming increasingly dangerous to wage a war. But if we, with our more powerful industry, larger investments and larger production, force the Soviet Union to keep pace with us in the arms race–it's simple enough to calculate which of us will be the first to experience economic collapse."*

Bernal and I then spoke about the sociological blindness of those technocrats. Even at that time Bernal was not in good health and so at the end of what was to be our last conversation I raised my glass to him and said: "Good health, dear friend! May both of us live to see the arms crisis of the USA!"

I have thought about this meeting with him several times in the past months and if he had not been so seriously ill, I would have written to him:

> *"Dear friend,*
> *Everything has turned out to be even more surprising and in many ways more spectacular than we imagined at our last meeting. Since we are both Marxists we could foresee at that time in Moscow, that the socialist economy of the USSR is incomparably more powerful and thus able to carry the burden of military expenditure more easily than the economy of the USA, since although*

> *not materially wealthier than the USA, it is free of the fundamental contradictions inherent in the latter.*
>
> *Something which we did not, and probably could not foresee at that time, is that at the very moment when it became clear that the US was no longer capable of arming and keeping its civilian goods industry going at the same time, at the very moment when the arms spending and war economy plunged the USA's entire economy into a serious crisis, the economy of the Soviet Union would not only be advancing as vigorously as ever, but would in fact be strengthened to such an extent, that Party and Government would be able to decide to accelerate the improvement of living standards. How wonderful, that the two of us should be living to see this change in events!"*

And yet, despite this fundamental difference in the effects of arming on the economy of socialist and capitalist countries, we are intensely interested in promoting disarmament as emphatically and quickly as possible. We are not interested in defeating the USA and all the capitalist countries in war or in arms, but in competition under conditions of peaceful coexistence by increasing labour productivity more rapidly, as Lenin demanded over half a century ago.

This leads to the logical conclusion, that, if arming and its constant intensification exert a negative influence on the development of technology and production techniques in the greater part of the economy, the removal of this burden will exert a positive influence, promoting the advance of technology and production. There are nevertheless two arguments, which we still have to deal with.

The first, frequently put forward also in non-military circles, asserts that the military managed to develop technology more rapidly than civilians had ever been able to do.

Nobody can deny this. What lies behind the particulary rapid development of arms technology?

For one thing, the specific nature of arms competition plays an important part. Let us compare aspects of civilian and military competition in production:

In civilian production the pressure of competition need not necessarily lead to technological improvements. If two competitors in two countries introduce refrigerators of equal technological value onto the market, it takes some time for international competition to become effective, and then the rival can be defeated without introducing any technical innovation, for instance by a more elegant design of refrigerator, or by a price reduction, which will bring higher profits with increased sales. A bomb on the other hand cannot be made more "competitive" by a more elegant design, or by reducing its price–in military production effectiveness and greater destructive power attained by means of improved techniques are all that count.

And then, military production, in contrast to civilian goods production, always demands development in two directions: if one's enemy possesses better missiles this means that one must greatly improve one's own missiles as well as one's own anti-missile-missiles or missile defence. All this takes place within the framework of technical improvements as such, whereas in civilian goods production the products must not only fulfill purely technical demands, but also comply with many other requirements, such as convenience, beauty, etc.; above all those goods must in general not exceed a certain price. In the arms industry the basic principle of the greatest destructive effectiveness sets the standards; in the civilian goods industry costs constitute an important factor...

Since arms production is far more one-sided in its purpose—mere destruction—and is therefore only intent on technical advance, it has naturally made greater advances in the fields of technology and production techniques than has production in the civilian goods industry. The nature of the competition, therefore, is one of the main reasons for the notably greater speed of technological development in the arms industry. The other reason is the fact that much greater sums of money are made available for arms technology than for the civilian goods industry.

The second argument, disseminated in particular by military circles, asserts that the arms industry is also of great benefit for the civilian goods industry. Undoubtedly, civil aviation, for example, with its several thousands of modern aircraft, has derived some advantage from the technology of the hundred thousand and more military aircraft in operation. Yet the advantages in this respect are very limited. Thus in 1970 N. von Goetz, in his publication "Forschungsökonomie in der Luftfahrtindustrie" (research economics in the aircraft industry), in which he examined the American aircraft industry, stated that out of 11,674 patents owned by the American government in 1961, and of which 85 per cent were kept secret, 1,487 were released for civil use and 297—i.e. only 3 per cent—actually found practical application in civil aviation.

aviation.

Almost equally miserable proportions were established by an examination undertaken on behalf of the Pentagon—"Project Hindsight"—into the relations between the development of military and civil technology during the period 1945—1965. Contrary to generally held views, this examination established that only approximately 5 per cent of the technical progress made in military production had found application in civilian goods production. This is an extremely significant statement of fact and particularly so in view of the source from which it comes.

The reasons for the limited spin-off, from arms technology into the civilian goods industry are, above all, the following:

1. The secrecy surrounding arms technology, which is only abandoned when a new technology makes the previous one appear outdated; this outdatedness, of course, does not help to stimulate its being applied in the civilian goods industry.
2. According to experiences gathered in the USA adapting arms technologies to the requirements of civil practice is frequently more expensive than an entirely new design.

Therefore there can be no question of the advances made in the arms industry having any major significance for progress in civilian goods technology.

In contrast to the second argument, which is completely false, the first assumes a very serious significance in as far as we shall have to exert a moral pressure upon the development of civil technology and techniques in the course of disarmament, a pressure very different from that exerted up till now. Here again, a very marked difference will become apparent between the capitalist and the socialist countries. I am not trying to say that nowadays there is no significant difference between the socialist countries as regards the speed and vigour of development in technology in the military and civil spheres. Every technologist knows how much faster bureaucratic obstacles are overcome, instruments, materials and above all research werkers made available for military research and development than for civil research–both in the capitalist as well as in the socialist countries. But it will be much easier for the socialist countries to bring about a corresponding change in the course of disarmament and detente, since, whereas in the capitalist economy profit is given priority, in the socialist society improvement of the living standard is the foremost concern in every respect.

Economic Problems of Destroying Chemical Warfare Agents

K. Lohs, GDR

Harnessing the fissionable material used in nuclear weapons for peaceful purposes is a relatively uncomplicated matter. Biological weapons can be destroyed by simple technical methods and without incurring excessive costs. Destroying chemical warfare agents, however, raises considerable technical and thus of necessity considerable economic questions.

The following statements on this subject take into account the facts published in international scientific literature, but the author's own personal opinion on these problems will be in the foreground. Therefore, I shall not present a kind of review article dealing with the whole range of economic problems arising in connection with the destruction of chemical warfare agents. I shall rather give my own opinion as a toxicologist and chemist on several arguments which, even if formulated in different ways, are continually advanced by the advocates of chemical warfare in discussions on banning the production of chemical warfare agents and the aspired destruction of existing stocks of chemical warfare agents.

The following is a typical example of such an argument:

> *"The destruction of chemical warfare agents is too great a burden for the national economy, since the safety measures which have to be taken involve greater costs than the precautions necessary for stockpiling. Supervision of the stockpiles is completely sufficient for international control."*

Another argument runs as follows:

> *"Since the storage stability of numerous chemical warfare agents is anyhow limited, cessation of production is sufficient. After several years the stocks will no longer be useful and the problem will have solved itself."*

Launched more or less cleverly by imperialist brass hats, in the last few years these and similar arguments have been reflected in the daily press and popular science publications of capitalist states. The majority of those advocating such "theses" have never seriously studied these problems, nor have they themselves gained practical experience on these problems.

Due to our fascist heritage we in the GDR have been confronted in a very direct way with the questions related to the destruction of chemical warfare agents, because the defeated fascist army and the IG Farben industry left several production and storage sites for numerous chemical warfare agents on our Republic's territory, and during the GDR's reconstruction period these represented a serious threat to the population as well as to nature itself as the living space for the population. The situation was even more complicated by the fact that all the documents as to the nature of the products and primary products and how to handle them as well as other essential information regarding the safety precautions to be taken before the products left the production and storage sites, had been destroyed by the fascists before they left these partly destroyed or heavily damaged production and storage sites. Time-consuming analyses and comprehensive ground searches had to be carried out especially in the case of drums containing chemical warfare agents or primary and intermediate products which had been buried, removed to some other place or sunk in rivers and lakes in order to limit the hazard to those in charge of destroying these warfare agents. Furthermore, we were short of experts who were able or willing to supply information on efficient detoxication processes. And finally, there was a shortage of physicians capable of treating any possible cases of poisoning in a satisfactory way.

In the fifties it was thanks to the courageous and exemplary action by the German People's Police that large quantities of such war materials were detoxicated and factories and their ground cleared so as to protect our citizens and to safeguard socialist reconstruction in the GDR. In accordance with the provisions of the Potsdam Agreement we demonstrated at that time that even under extremely unfavourable conditions it is possible to destroy chemical warfare agents in quantities of twenty or more tons. In view of the possibilities which present-day technology offers and in view of the scientific facilities available, such industrially advanced countries as the USA, Great Britain and France can be expected–even taking into account the fact that the warfare agents preferred nowadays from the series of the extremely toxic V agent phosphoric acid derivatives necessitate considerable safety precautions–to carry out a destruction programme within a short period which is entirely sound from a safety precautions point of view. Needless to say, the military chemists in these states know this quite well! But the discussion on the economic costs of such destruction campaigns serves only one aim–to divert attention from the heart of the problem, i.e. the maintenance and further build-up of the reserves of chemical warfare agents.

If one bears this in mind, the sinking of sarin grenades last year in the Atlantic Ocean by the USA appears in a different light. From a technical point of view it would have been possible to destroy this–compared with the real stockpiles of warfare agents in the USA'relatively small number of Sarin grenades and containers in a suitable way on land. We are certainly not wrong in supposing that those who were responsible for this action knew beforehand that such a demonstrative sinking in the Atlantic would trigger off anger and indignation among world public opinion. This justified indignation was not so much directed against the quantity of Sarin sunk (which, in the light of its hydrolytic half-life period, as well as the water quantity available for its dilution and that of its decompositon products, did not contaminate the whole ocean), as against the condemnable practice of using the oceans as a cost-free global refuse dump and of letting other operations of a similar kind follow this first one.

There is no doubt that the Pentagon took this state of affairs into account, but this demonstrative act was meant not least of all to add grist to the mills of those who, in the face of the tremendous quantities of chemical warfare agents already stockpiled, contend that an economic and at the same time safe detoxication is not feasible from the technical point of view. This, however, would be equivalent to saying that there is an "economic pressure" to continue stockpiling, and thus to legitimising the possession of such agents even if one day it will be impossible to evade a ban on producing these weapons: in this way one wins time until the fusion toxins at present under development, are ready to replace the present chemical warfare agents which will then only be of interest for military historians. In the same way, the argument that warfare agent stocks will detoxicate themselves in time can only be assessed as a delaying tactic under an economic pretext, and as an attempt to shroud the real stocks of warfare agents in secrecy. It is evident that, depending on the quality of the chemical warfare agents stored, time-dependent decomposition does take place which leads to a gradual loss in effectiveness. The degree of such decomposition, however, is dependent on such a multitude of chemical and physical factors that it is impossible to guarantee that the poisoning hazard is fully removed unless suitable means and methods of detoxication are used. In addition to this, there are quite a number of cases in which intra- and inter-molecular reactions in some toxins even result in an increase in effectiveness (let me remind you of the increase in toxicity caused by the transalkylation of the esters of the phoshoric and phosphonous acids with thio-ether or secondary amine groups in the acyl side chain). In the case of sulphurous Yperite it is known that decomposition products can act as stabilizers which can lead to a state of equilibrium between sulphurous Yperite and its metabolites lasting for several years. Other observations have shown that sulphurous Yperite, because of its low solubility in water, can be preserved by supernatant water, for example in duct systems of partly destroyed production and storage sites, and thus remain fully effective for more than a decade. The list of such examples could be considerably extended.

Since, in principle, all chemical warfare agents because of the reactivity necessary for their effectiveness can be reacted with chemical compounds which inactivate or detoxicate them, it is necessary to produce these detoxication agents in the required quantities and to provide technical facilities that permit the detoxication processes to be carried out in an entirely safe way. The costs of detoxicating chemical warfare agents are considerably influenced by the suitability and also optimum economic organization of the detoxication processes. "Cheap" solutions are not available in this case! However, the financial expenditure required represents only a fraction of the amount which, contrary to reason, drained off from the national economy every year to cover the costs of research, development and production in the field of chemical warfare agents. On no account should disarmament measures hang in the balance because of economic considerations. Nor should the opponents of disarmament be allowed to bring about fear and dangers by intentionally organizing technical mishaps.

Chaotic sinking, burying or seeping of warfare agents as tried in many places in 1944/45 by the German fascists in their attempts to cover over the traces of their criminal deeds, resulted as already mentioned in expensive and dangerous clearing-up campaigns having to be carried out for almost two decades after the end of the war. If the provocative sinking of US Sarin grenades were continued this would result in serious damage to ocean ecology with unforeseeable economic consequences. In the same way, the "under-cover-of-night-actions" of civilian chemical enterprises which have come to light in Western industrial states in the last three years, i.e. the attempts to dispose more or less secretly of toxic substances (e.g. dumping them on waste-heaps or sinking them in rivers and coastal waters or the case a few months ago, which caused a public scandal in the Federal Republic of Germany, when it was discovered that reckless hauliers had deposited arsenic sludge and cyanide concentrates on cultivated land) show the devastating results which can be produced for man and nature when people act in such an irresponsible way towards society.

Let the chemical trusts in imperialist states, which still consider cooperation in the production of chemical warfare agents to be *the* big business, realize that the peace-loving forces of the world will not only force a ban on producing and stockpiling chemical means of mass annihilation, but will also see to it that the existing chemical and technical facilities are used for destroying the whole arsenal of chemical weapons in a way that is commensurate with environment be shown once more that dealing in war and death is the most despicable business there is.

The History of Disarmament since 1945

J. Moch, France

Despite the humanitarian efforts of the pacifists at their repeated congresses from 1847 to 1914, despite the Hague conferences of 1899 and 1905, despite the 192 arbitration treaties valid since 1914, despite the disarmament negotiations conducted for eight years from 1927 to 1935 under the sponsorship of the League of Nations and for 26 years within the framework of the United Nations we must note four sad conclusions:

1. According to various estimates the cost of the two World Wars to mankind was 47 to 60 million dead. The entire sum of expenditures for the two wars, reconstruction and war pensions amount to 150 thousand million gold dollars for France alone, i.e. for the ten years of their duration an additional thirty years of labour for all Frenchmen.
2. In the 71 years of our so-called civilized century there have been 69 years of war and only two years of peace throughout the whole world, 1910 and 1927.
3. Sixty-nine of the greatest powers among the 137 independent states spend 169 thousand million dollars per year for military purposes, 78 thousand million by the USA, 42 thousand million by the Soviet Union[1], 7 thousand million by China and 6 thousand million by France, which is regrettably to be found in the fourth place after the leaders. This represents an average burden of 60 dollars per head of world population per year, whereas in the USA it amounts to 369 dollars, in Israel to 224 dollars, in the USSR to 169 dollars, in Sweden to 128 (because of astronomical sums for civil defence) and 121 dollars in France.
4. This waste of military expenditures is countered by the slight amount of aid which the thousand million inhabitants in the rich countries, whose national incomes per head of population lie between 1,500 and 4,000 dollars per year, grant to the two thousand million poor whose per capita income is less than 200 dollars. All the forms of this aid taken together do not exceed 12 thousand million dollars per year, i.e. six per cent of the military expenditures for the whole world. They cannot compensate for the population explosion which is further accelerated by the introduction of improved hygiene. Thus, the gap between them is becoming wider and wider, and the misery of the poor grows incessantly.

[1] All estimates of Western statistics on the defence expenditures of Socialist countries are questionable in view of currency calculations. The Ed.

To double the standard of living of the thousand million people with an income of less than 100 dollars per year this aid would have to be increased from 12 to 35 thousand million dollars and also utilized more efficiently. With today's military burdens the industrial countries are not able to supply these extra sums. The first stage in step-by-step disarmament would, however, suffice to reduce military expenditures by 20 per cent, i. e. would save 34 thousand million dollars, two thirds of which could be transferred to an International Aid Fund thus practically solving the problem of hunger throughout the world.

Negotiations since 1945

Negotiations have been going on almost uninterrupted since 1945. First, there were two committees of eleven states each, one dealing with atomic weapons and the other with conventional weapons. At the joint suggestion of the American Jessup, the Englishman Selwyn Lloyd, the Soviet citizen Vishinsky and myself those committees were united in 1951 to form a disarmament commission, which met in the hustle-and-bustle like atmosphere of the United Nations during the flourishing period of McCarthysm, so that I soon after proposed transferring its authority to a subcommission with five members which was to meet outside the public gaze in order to avoid the effects of propaganda, and outside the USA in order to escape the intellectual climate reigning there at that time.

This committee, which included Great Britain, Canada the USA, France and the Soviet Union, had its seat in London. In 1957, however, the Soviet Union withdrew and declared that it did not want to continue the negotiations alone against four western powers.

A new commission of ten countries (five from each bloc) was formed in Geneva. The Soviet Union cooperated for a certain time and then withdrew again, this time to bring about participation of the non-aligned states.

Thereupon the 18-nation commission came into existence in 1961 in which eight non-aligned countries took part and which transferred the permanent direction jointly to the Soviet and American delegates. These soon expanded their authority so far that membership was raised from 18 to 26, of which only 25 were represented, for de Gaulle decided that France would not take part.

Parallel to this the direct talks conducted since 1961 between the American McCloy and the Soviet representative Sorin led to agreement on the principles of a treaty on general disarmament which came very close to what France had proposed nine years earlier. Contacts were then taken up in Helsinki between two of the five atomic powers and later in Vienna under the name SALT (Strategic Arms Limitation Talks).

Further, the NATO is investigating in Brussels the possibilities of balanced disarmament. The European Security Conference is under discussion. Disarmament is discussed every year at the UN General Assemblies. Numerous committees of experts are investigating its technical aspects: the ionization effects of radiation, defence against surprise attacks, reorganization of industry in case of disarmament, etc.

The Hope of 1954

Primarily general disarmament was discussed at the beginning of this period. Interesting proposals were made. The French plan of 1952, which envisaged three stages of two years each and which was also supported by Britain from 1954 onwards, would almost have led to the main objective since the USSR agreed to accept its principles as a basis of discussion. This decision, which was taken in August 1954, was not made known until December at the UN General Assembly meeting. But between these two dates the rejection (at my request) of the plan for a European army by the French parliament unfortunately led to separate rearmament on the part of the FRG which again nullified all the successes achieved on the road to peace.

The summit conference in Geneva in June 1955 was thus turned into a dialogue between deaf and dumb persons which, badly prepared and badly organized, again nullified all that had been referred to as the "spirit of Geneva", and which did nothing for peace.

Difficulties Arising from Technological Progress

As a result of the constant acceleration of technological progress the problems change quickly and become extraordinarily complicated.

Thus, in 1946, when the Americans proposed the Baruch plan for controlling atomic energy, this system of control measures, which would have made disarmament possible, could still have been implemented even though it had a certain margin of error. However, because of the then very slight stockpiles this margin amounted to less than the charge of a single bomb and was therefore acceptable. The same method today would mean uncertainty over several hundred missiles and would therefore not be acceptable.

The problems existing today are incomparably more complicated than they were earlier. Atomic weapons are being overtaken by thermonuclear weapons. Their range, which at first was in the intermediate magnitudes are today, on the one hand, becoming intercontinental and, on the other, reduced to a few kilometres. Their explosive force which at first amounted to some 20 kilotons has, on the one hand, grown by more than 200 times and, on the other, has become only one twentieth the size for tactical weapons. The delivery vehicles, which at first followed straight flight paths can now zigzag almost from one pole to the other so as to be able to avoid regions protected by radar. In place of the original single warhead the missiles of today have up to 14, which prolong the original flight path for the MRV (Multiple Re-entry Vehicles) or, with the MIRV (Multiple Independent Re-entry Vehicles), each have their own flight path so that a single missile could destroy 14 of the largest cities. And finally there are the anti-missile missiles (ABM: Anti-Ballistic Missiles), which search out and destroy attacking missiles, the one type going into action in cosmic space at an altitude of several hundred kilometres and at a distance of thousands of kilometres, and the others, which are considerably faster, going into action on entering the atmosphere at altitudes and entering of less than 100 kilometres. All these missiles are guided by automatic radar and computer installations, the cost of which, as of the missiles themselves, surpasses the imagination.

Biological weapons are a hundred times as effective as thermonuclear weapons and 100 million times stronger than conventional explosives. In order to destroy with certainty all life in an area of 1,000 metres by 1,000 metres, 16,000 artillery shells (75 or 77 mm) would have to be fired, i. e. ten tons of conventional explosives used. The same result could be obtained by using one ton of chemical weapons or ten kilograms of atomic explosives, as was the case at Hiroshima, by then grams of thermonuclear explosives of the present type or by only *0.1 grams* of biological substances. Those are truly frightening figures!

Universal Destruction

Ten missiles with an explosive force of one megaton, i. e. the equivalent of one million tons of conventional explosives (and there are missiles which contain fifty times as much explosive force) would suffice to extinguish practically all life in the GDR. The Americans have some 2,200 of such missiles with which 50 million square kilometres could be completely devastated, i. e. twice the area of the USSR. On the other hand, although the USSR possesses somewhat fewer intercontinental missiles, the territory of the USA is also smaller...

Furthermore, the USA and the Soviet Union each possess some 40 nuclear-powered submarines which can remain under water for six months and each of which is equipped with sixteen missiles armed with ten or fourteen multiple warheads of the MIRV type. Each of these vessels has a firepower which is several times greater than the entire firepower employed by the land, air and naval forces of the two warfaring camps during the ten years of the two World Wars. As long as only two countries possessed such submarines one knew in case of attack that it could only have come from one of the other sides submarines. But today at least four countries possess such submarines. Imagine the case of panic leading to hasty decisions if a submarine with the abovementioned firepower were to attack one country or other: it would not be possible to determine its nationality!

However, we should not look upon the matter too pessimistically. Even though the disarmament and control problems are becoming more and more complicated the danger of an intentional war is also lessening, the emphasis lying on intentional, although the danger of a war arising by accident or in a panic situation still remains...

Meagre Balance

The double spiral of improvement in weapons and growth in arms expenditure thus continues. Lester Pearson, former Canadian Prime Minister and winner of the Nobel Peace Prize, once said:

> *"Once a missile has been designed, it is already out of date."*

This is completely true and one should also add that the new missiles which replace the old ones cost five to ten times as much.

Thus certain limited measures have become necessary simply as a result of the rapidity of this double development, measures which are concentrated in six different fields:

It has been decided that the Antarctic, which at present is not militarized and also free of nuclear weapons, shall also in the future remain free of all weapons. It has likewise heen decided that Latin America shall remain free of nuclear weapons. It is armed–to the detriment of the stability of its governments–but not with nuclear weapons. These two agreements which stabilize the status quo, were, incidentally, negotiated outside the disarmament bodies.

The cessation of atom bomb tests, with the exception of those taking place underground, has been laid down in a treaty to which France has not acceded and which was worked out by the international Pugwash movement. This treaty contributes more to consolidating the position of the nuclear powers and is not so much a step towards disarmament.

The same is true of the Non-proliferation Treaty which has not yet come into force since not enough countries have ratified it. It forbids the five atomic powers to transfer atomic weapons or data on their production to other powers and prohibits the latter to produce or procure such weapons.

A fifth treaty prohibits the stationing of nuclear charges in outer space, and a sixth envisages exclusively peaceful use of the ocean bed, but not in an unequivical form; although it prohibits the construction of manned or unmanned underwater stations it does not prohibit the employment of atomic submarines which can lie at the bottom of the ocean for months in combat readiness.

There was recently a narrowing of differences as regards prohibition of the production of biological weapons and in the SALT talks as regards limitation of the extremely costly race for technological superiority in the nuclear field. Tangible results have, however, not been forthcoming. It should nevertheless be noted that the government of the USA in April 1971 decided unilaterally to destroy its stocks of biological weapons, which in the words of the government spokesman would suffice "to annihilate the population of the earth several times over."

Destroying these weapons will cost, according to the same spokesman, more than 12 million dollars and invoice 298 chemists and biologists full time for an entire year! It is probable that the Americans will not unilaterally destroy their entire stocks as long as other countries do not join in. These are the only tangible results up to now. Should one despair in view of this meagre balance? No! The establishment of lasting peace is a necessity for every civilzed man. This is not only a question of political conviction, of philosophy or religion, but a universal moral commandment outside every confession or political line.

Thus we believers and non-believers appreciate the peace struggle of the present Pope and his predecessor John XXIII. I had the honour of getting to know John XXIII more closely, of meeting him several times in Rome, speaking to him about disarmament and seeking his support for its champions. I always remember these meetings with inner emotion and joy.

John XXIII wrote the following lines on April 2, 1963 in the encyclical "Pacem in terris" which should serve as a guiding line for all statesmen:

> *"An attempt is made to justify armament by repeating that in the present situation peace can only be ensured by a balance of armed forces. Thus every increase in military potential in one place calls forth a redoubling of the efforts on the part of the other states along the same lines. And when a political community is equipped with atomic weapons this fact moves the others to procure similar weapons. Thus, mankind lives in constant fear. A surprise, a chance event, would suffice to plunge the world into a conflagration. Justice, reason and a sense of humanity thus demand that the arms race be stopped. They demand a parallel and simultaneous slow-down in the arms race in the various countries, the prohibition of atomic weapons and finally a jointly adopted disarmament program carried out accordingly and effectively controlled."*

This has been precisely France's attitude since 1960.

Paul VI said on December 5th, 1964:

> *"May the nations stop the arms race and channel their resources and energies into brotherly aid for the developing countries"*

We have also constantly championed this thesis.

On October 4th, 1965 Paul VI declared before the United Nations General Assembly:

> *"We must resolutely approach the new era in history, the era of peace. The paths towards this have been marked out. The first is disarmament. Searching for ways of guaranteeing the security of international life without the use of armed force is a worthwhile aim for your efforts. This, gentlemen, is what must be achieved."*

Yes, the fate of peace is linked with disarmament. As long as weapons and armies still exist the danger exists that peace is only a nervy pause for breath between ever more frightful conflicts.

Although disarmament is a necessary prerequisite for peace, it alone is not enough. Two aims must be pursued at the same time.

One is gradual settlement of the conflicts in Vietnam, the Middle East, Korea and elsewhere whose beginnings can already be seen. The actual technical disarmament negotiations are too often slowed down by insufficient diplomatic progress in the direction of détente. But one step forward makes the next easier. A limited disarmament measure contributes to relaxing the international atmosphere and to diplomatic improvements. On the other hand every easing-off in political conflicts, as, for example, in Berlin, makes new disarmament measures possible.

The other aim is the establishment of a system of maintaining unarmed peace, i. e. a system in which peaceful settlement of future disputes is obligatory, where disputes are settled by arbitration and the decisions adhered to and enforced. This body would challenge the unlimited sovereignty of the states. But the whole of modern development, of our quickly changing and ever costlier technology make regional groupings and later even a world government necessary, with all supra-national bodies being at first granted precise and limited authority, which is then gradually expanded.

What could be a nobler goal than solving international conflicts on a supra-national level, as private conflicts between citizens are nowadays settled independent of the will of the participating parties.

Incidentally, disarmament will begin before this organization for protecting peace is established; for its realization, however long it may take, will crate such a climate of trust that the states will be tempted to a lesser extent than today to make use of threats or even the use of force.

The entire civilized world wants wars to disappear once andfor all. It will finally understand the necessity of step-by-step disarmament. Then the fate of peace will be ensured. My teacher and fried Léon Blum agreed in this connection with John XXIII and Paul VI: "I hope and I believe", he wrote, "I belive it because I hope for it."

Technical Control and the Non-proliferation of Nuclear Weapons

G. Schumann, GDR

During all disarmament talks one of the most important questions has been nuclear disarmament. It is the declared aim of the USSR, the states of the Warsaw Pact and many non-aligned countries to arrive at a complete ban on nuclear weapons in order to banish for ever this terrible weapon from the arsenals of all countries. It is, however, obvious that this goal can only be reached step by step. The first step was taken in 1963 with the conclusion of the "Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water". The essential importance of this treaty for the benefit of mankind consists in the fact that the radiation hazard caused by nuclear tests has been reduced considerably...

Measurements in the State Centre for Protection Against Radiation in the GDR show clearly that the radiation level in the atmosphere, plants, arable soil and thus also in foodstuff has decreased since this treaty came into force. Thus, for example, the average annual values of the Strontium 90 concentration in milk (in the Berlin area) have diminished as follows:

Year	*1963*	*1965*	*1967*	*1969*
Strontium 90 concentration (PCi/l)	16.3 ± 4.16	13.2 ± 1.07	7.5 ± 0.77	5.0 ± 0.41

A second world-wide step has been taken with the "Treaty on the Non-proliferation of Nuclear Weapons", in brief the Non-Proliferation Treaty, which was concluded on 1 July 1966 and came into force on 5 March 1970 after having been ratified by the depository governments, i.e. the governments of the USSR, the United Kingdom of Great Britain and Northern Ireland and the United States as well as 40 other signatory states, among them the GDR.

The significance of this Treaty–as will be seen in the following–is underlined by the fact that nuclear energy has nowadyas already obtained industrial importance and that it is developing into a genuine alternative to fossil fuels. At present nuclear power stations account for some 20,000 MW of installed electric power, in 1980 there will probably be 340,000 MW of installed power from nuclear power stations in the world, and in the year 2,000 more than 4 million MW of nuclear power station capacity are expected.

In the reactor–the heart of the nuclear power station–the following processes which are essential for our deliberations–take place: the nuclear fuel used consists generally of uranium of different composition; one part of this fuel–the uranium isotope 235–is split by neutrons. This is the reaction by which the energy stored in the nucleus is set free for technical application. Another part–the uranium isotope 238–is transformed in several steps into the plutonium isotope 239 by neutron capture. This process is very interesting from the point of view of power economy, for while it is taking place, a new nuclear fuel, plutonium isotope 239. is produced artificially out of the non-fissionable uranium isotope 238. This, in principle, is the process which takes place in "thermal" reactors used nowadays. These are reactors in which the neutrons are slowed down with thermal energy, as the uranium isotope 235 is only fissionable by means of such slow neutrons. A similar process takes place in the so-called thorium-uranium cycle where the fissionable uranium isotope 233 is produced artificially out of thorium 232.

In the future the "quick" reactors–also called "breeder reactors"–will play an important role. It is calculated that they will be used industrially between 1980 and 1985. Here the neutrons are not slowed down. Plutonium is used generally as nuclear fuel. In the quick reactors the actual active zone in which nuclear fission takes place is surrounded by natural uranium or by uranium free of the isotope 235 in which the neutrons leaving the active zone generate plutonium 239 out of the existing uranium 238. This is in principle the same process as takes place in thermal reactors, only with the difference that the generation of plutonium is greater. The term breeder reactor stems from the fact that it generates more nuclear fuel than it consumes.

In a nuclear power station with a pressurized water reactor, for example, during normal operation approx. 1 kg of plutonium 239 is generated when 1,000 MWd of electrical energy is supplied to the network. In a nuclear power station with a quick reactor, 4 to 5 kg of plutonium are generated for the same amount of energy. For this reason the "quick breeder reactor" is very attractive from the point of view of power economics.

This is one side of the generation of plutonium in nuclear power stations. The other side, however,–and for this reason I went into some technical detail–is that plutonium can also be used in nuclear weapons as an explosive. The prerequisite for this is that plants are available in which plutonium is extracted in the pure state necessary for the manufacture of nuclear weapons, since in addition to the plutonium 239 considered here other plutonium isotopes are also generated which cannot be separated from each other chemically. Therefore, special isotope separation methods are required.

The development of the ultracentrifuge in which the Federal Republic of Germany is participating shows that the extraction of pure plutonium 239 from exhausted nuclear fuels is a problem which can be solved technically.

With uneconomic operation of a nuclear power station, i.e. when the nuclear fuel is allowed to radiate for short periods only, it is even possible to generate relatively pure plutonium 239 so that isotope separation methods are not absolutely necessary.

Due to the possibility of also using plutonium for the manufacture of nuclear weapons the significance of the Non-Proliferation Treaty becomes clear. This treaty prevents states which do not possess nuclear weapons from obtaining them. This requires–in addition to a corresponding statement in accordance with Article I and Article II of the Treaty–an effective measure of control. This control is carried out, according to Article III of the same Treaty, by the International Atomic Energy Agency (IAEA) which concludes corresponding control agreements with the partner countries for this purpose.

From the exposition on the generation of plutonium and the possibility of its misuse in nuclear weapons, two principles arise which are prerequisites for effective control.

a) There must be available a constant, exact survey which must be substantiated to the control body on the quantities of nuclear fuel and its state existing in the country.

b) For this all the nuclear material of a country must be controlled. This is the qualitatively new aspect in comparison with previous controls which the IAEA has carried out on the basis of its "guarantee system" and within the framework of bilateral or multilateral agreements. Here it was up to the party to the treaty to decide which nuclear plants were to be submitted to control.

It has to be added–and this is already stipulated in Article III and Article IV of the Non-Proliferation Treaty–that the state, economic as well as scientific and technological interests of the parties to the Treaty may not be jeopardized by the control measures. Therefore, these should be carried out largely with the aid of equipment and other technical means at determined key positions.

Nevertheless, certain countries, especially the Federal Republic of Germany, have raised doubts about the Non-Proliferation Treaty just in this respect.

The German Democratic Republic which acceded to the Treaty very early and ratified it even before it came into force, has emphasized from the beginning the untenability of such doubts. Although the Treaty came into force more than 18 months ago the government of the FRG has not yet decided to ratify it.

In accordance with the draft presented by the IAEA on the structure and the contents of the agreements to be concluded on the control of the Non-Proliferation Treaty, technical control is to be carried out according to the following principles:

1) The whole movement of nuclear material in the country is to be controlled and is divided into so-called material balance zones. This means that after the initial stock-taking of nuclear material each export or import and each transport for nuclear purposes, the use in reactors or other plants and consequently the loss and/or generation of new nuclear material is to be registered. It is the declared aim of this measure to ensure that nuclear material is not diverted for nuclear weapons or other nuclear explosives

and that any intentions of this nature are spotted in time in order to initiate appropriate measures.

2) The movement of the whole nuclear material can only be followed up if corresponding measuring spots are fixed for control purposes in all nuclear power stations of a country. In accordance with the treaty this refers to all plants in which nuclear material war a certain quantity is used or deposited, i.e., this control refers to all reactors, all plans generating or reprocessing nuclear fuel, all isotope separation plants, all laboratories in which work is carried out with larger quantities of nuclear fuel, etc.

3) In order to guarantee the protection of commercial and industrial secrets, not to impede economic and technological developments as well as international collaboration between the countries to be supervised and in order not to increase too much the personnel and financial expenditure of the control a series of measures are envisaged. These include:
Supervision is to be carried out at certain so-called strategic points largely by means of measuring instruments and other technical methods to which belong the sealing of the storage facilities, the use of statistical methods and random sampling when following up the movement of nuclear material or concentrating the control on such points in the nuclear fuel cycle at which the diversion of nuclear material for use in nuclear weapons is most likely.[1]
The state which has concluded a control agreement with the IAEA introduces a national control system for the movement of nuclear material.[2]
By means of such a national accounting and control system – which is not only significant because of the Non-Proliferation Treaty – information can be given at any time to the IAEA on the distribution and state of nuclear material in the country. On the other hand, the IAEA, as the control body, receives information on nuclear plant design or can take a look itself at all power plants the country to the extent required in order to survey and follow up the movement of nuclear material in these plants. If, for example, the basic technology of a nuclear power station is known to the IAEA – today this is no longer a secret and generally does not go beyond usual publications on nuclear power stations – and if the electricity supplied by the power station to the network in a certain period of time is also known, then the amount of nuclear fuel used and/or the amount of plutonium generated during this time can be calculated easily.
Both factors – the national accounting and control system and the information on plant design to be handed over to the IAEA – enable the control body to limit direct on-the-spot control to a minimum.
In order to avoid unnecessary expenditure these plants or nuclear material quantities are excluded from control for which misuse outside of peaceful purposes is out of the question.
Furthermore, uranium and thorium ores are excluded from control. This starts only when the ore is processed into nuclear material which can be used in power plants.

4) Control by the IAEA is carried out on the basis of reports which are to be handed over to the IAEA by the contracting party. In order to verify these reports the IAEA carries out ad hoc, routine or special inspections in the country. When doing this the inspectors are authorized, in addition to using the measuring, test and control equipment of the particular country, to carry out independent measurements with their own equipment, to check the mode of operation and the calibration of instruments and other control equipment as well as the integrity of sealed plants, such as storage facilites. Details concerning these measures are regulated by the contracting parties. At any rate it is guaranteed that this inspection cannot lead to a violation of commercial and technological secrets, because the inspectors are only allowed to enter certain places determined beforehand and the inspections are to be announced in good time. In addition, the inspectors are obliged to observe secrecy towards third parties, and it is possible that under certain circumstances a limitation of the rooms accessible to the inspectors can be agreed upon by the contracting parties. Moreover, it must be ensured that the operation and safety of the nuclear plant is not affected by the inspections and that the inspectors can be accompanied by persons appointed by the state concerned.
   The main principle to be observed during the inspections is that these are to be limited to a minimum by the utilization of instruments and other technical means.

The observations made on the contents and the carrying-out of technical control allow two conclusions to be drawn:

a) The control system has been elaborated in such a way that it will meet the main aim of the Non-Proliferation Treaty: to prevent or spot in time the abusive diversion of nuclear material for purposes other than peaceful use. The high probability of discovering the diversion at an early stage is an important deterrent.
b) No disadvantages regarding the economic, technological and scientific development of the contracting parties result from the control system. The only disadvantage consists in the additional financial and personnel expenditure which, however, should not play an important role when one considers the great strategic aim of the Non-Proliferation Treaty–to liberate mankind from the scourge of nuclear weapons.

These two conclusions are confirmed by studies carried out by Skvorcev and Miller on behalf of the IAEA. The authors write:

> *"The studies carried out showed the possibility to implement in a satisfactory way, by sufficiently simple and accessible means, the IAEA guarantees for reactors cooled with pressurized water."*

The fact that these studies were carried out on a special thermal type of reactor, the so-called pressurized water reactor, should hardly restrict the general validity of the conclusions drawn under sections a) and b), for the pressurized water and the boiling water reactor constitute approximately 50 per cent of all nuclear power stations in operation at the present moment, and this situation will not change very much by 1980, although it is likely that the percentage of these types of reactor will further increase. Even if specific other types of reactor have specific features, the general conclusions will be transferrable in principle to other types.

I hope that my paper on technical control in connection with the Non-proliferation Treaty has shown that the treaty *can* be realized from this side. It is now up to the governments throughout the world to ratify the Treaty and conclude the corresponding control agreements as has already been done by the government of the GDR which entered into negotiations with the IAEA in accordance with its obligations resulting from the Non-proliferation Treaty...

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[1] By the nuclear fuel cycle we understand the circulation of nuclear material including its use in the reactor, removal and storage of the exhausted fuel, its reprocessing as well as storage of the reprocessed nuclear fuel and the fuel cassettes manufactured out of reprocessed nuclear fuel and on once more to its renewed use in the reactor.

[2] This has already been carried out in the GDR by the "Decree on the Control of Nuclear Material" of 5 August 1970.

Possibilities of Legal Protection for Scientists in the Fight against Mass Destruction Weapons

P. A. Steiniger, GDR

According to Article III of the draft convention on the prohibition and destruction of bacteriological (biological) weapons, which has been elaborated by 12 states of different character in the Committee on Disarmament at Geneva and which is expected to be confirmed by the 26th session of the UN General Assembly, each state party to this convention is obliged "in accordance with its constitutional processes to take any necessary measures to prohibit and prevent the development, production, stockpiling, acquisition and retention of the abovementioned weapons within their territory...".

According to Article VIII of the draft convention all member states also proceed, in principle, from the "recognized prohibition" of chemical weapons.

According to the suggested definition of the "aggressor", which is at the moment on the agenda of the present UN General Assembly and also up for codification, using nuclear weapons first must be regarded as an aggression.

Even though a convention covering the ban on all weapons of mass destruction has not yet been agreed upon, much less come into force, we can state that even now these weapons–in the case of nuclear weapons, using them first–are outlawed by international law, i.e. their unlawful use constitutes a crime against peace, a war crime. It is well known, that participation in such crimes–no matter whether they are committed at the behest of the state or not or whatever form they take–implies, at least since the Nuremberg Trial, criminal responsibility by international law of the parties concerned.

Since nobody can and may be expected to participate in a crime, it follows that any scientist whose services are used for purposes contrary to international law has an individual right even today to resist, and not only a moral duty to resist all attempts at getting around the ban. On the other hand, this logically implies a claim to protection against any kind of discrimination as a consequence of exercising the right to resist. When Article III of the convention on the prohibition of bacteriological (biological) weapons has come into force, all member states will also be obliged by international law to grant such protection.

Today this protection constitutes a sociological and juridical reality in those states which initiated the international struggle against ABC weapons and which continue this persistent struggle in accordance with their social character. In the GDR, for example, all the necessary safeguards are present in the system of its social, state and legal order, and stipulated by the Constitution, penal code and labour code. Thus Article 17 of the Constitution explicitly prohibits any abuse of scientific work directed against peace, and § 93 of the Penal Code from 1968 declares the use of prohibited weapons and the orders for such use to be crimes.

It is a problem now, and will certainly be a problem even when the convention has come into force, of protecting legally and factually those scientists who responsibly and lawfully pursue their work in countries where aggressive circles exercise a social influence or even directly decide the policy of the state. Here I see two possibilities of protecting the scientist, who takes his own responsibility seriously as regards implementing the ban on the most dangerous weapons, from being discriminated against:

1. at an interstate level: an appropriate exact definition of the international obligations of the member states as provided for by Article III of the convention, obligations which are far more concretely defined in the Soviet draft of 1969 on the prohibition of BCW submitted to the UN.
2. at a national level: control of the observance of the ban by the trade unions and other social forces in the particular country that are prepared to do so. In my opinion, such control should be demanded and encouraged by us. If I remember rightly, it was even during the disarmament debate of the League of Nations that similar domestic control by the trade unions was demanded. In view of the present state of international development it now seems much more realistic than in those days to introduce this idea into the international debate, to advocate it and, if necessary, to avail oneself of this protection either individually or collectively.

That is why we suggest encouraging such an exact definition of the convention as set forth above, and discussing at this Conference the issue of trade union protection for scientists in the country concerned. If we advocate a renewed and expanded "Hippocratic Oath" and condemn any abuse of science for aggressive purposes, for the purpose of genocide, then we must not stop at mere rhetorics but make this an instrument which will enable us to make a real contribution towards safeguarding the peace of the world, and the life of mankind.

The Stages of Disarmament Talks (1945–1971)

V. Trukhanovsky, USSR

The problem of disarmament, complete or partial, occupied the minds of politicians, statesmen and public figures long before World War II. That is why the founder of the Communist Party of the Soviet Union and the Soviet state, Vladimir I. Lenin, in this time said: "Disarmament is the ideal of socialism".[1]

Two main arguments were and are used in support of disarmament: a) disarmament is a way of reducing the threat of war and of preventing it, and b) disarmament would remove the burden of military spending which affects above all the working classes. After World War II, when the scientific and technological revolution spread into arms production and military affairs and brought about great changes in these fields, a new argument in support of disarmament arose: the need for saving mankind from a nuclear war which might have catastrophic consequences. These consequences are so horrible that no sane politician would risk releasing them, whatever ends he may pursue. In the present conditions the "old" arguments in favour of disarmament–those of lessening the war threat and cutting down military expenditure–have also acquired stronger significance because with the spread and expansion of the military and technological revolution, the threat of a new world war is also growing alongside rapid arms production and this causes a steep rise in military spending. During two decades (1949–1969) war spending grew three times (in stable prices) and amounted to £ 55,156,000,000–ten times the amount spent on war preparations in 1933.[2]

The struggle for disarmament in the last quarter of a century has been taking place under new socio-political conditions. The growing influence of socialism which led to the establishment of the world socialist system and the victory of revolutions of national liberation as well as the creation of many new independent states in place of former colonies has resulted in sharpening class contradictions in international relations and has made the reactionary imperialist circles even more determined to resort to armed struggle in fighting against revolutionary changes taking place throughout the world. At the same time the growing complexity of military hardware and greater arms spending have considerably enlarged the number of industrial and financial enterprises which profit from the arms race and, consequently, have a vested interest in keeping it up and further extending it.

However, there has been a simultaneous growth of forces which are objectively interested in disarmament and are constantly stepping up the struggle for the realization of this goal. They are the socialist countries, the international labour and communist movement and the forces of national liberation struggle. It is a regularly observed tendency in post-war development that popular masses play an increasingly important part in world politics and the voice of the peoples, which more and more favours disarmament, can no longer be ignored by the governments.

The first stage in the struggle of peoples and governments for disarmament in post-war years, or the first phase of disarmament talks, roughly embraces the years 1946–1952. The specific nature of this period lies in the fact that at its beginning the USA had a monopoly in atomic weapons which it lost towards the end of the period in question. In those years the imperialist circles were determined to preserve their temporary advantage in the area of up-to-date weapons and utilize it to attain their far-reaching goals in world politics. Therefore their participation in the arms talks was simply a smokescreen to conceal their real policy.

The members of the Great Alliance which defeated fascism in World War II agreed during the war on the need for working towards disarmament in the post-war world. The declaration on general security (adopted in Moscow, October 30, 1943) by four states–the USSR, the USA, Great Britain and China–stated that the governments of these countries will consult and cooperate with each other and other members of the United Nations with a view to achieving a general agreement on the regulation of armaments in the post-war period."

After the war had come to an end the Soviet Union began an intensive struggle for disarmament which it continues today. At first this struggle had to be waged in somewhat unequal conditions: the US had the Bomb, the Soviet Union did not. Following the development of its own atomic weapons the Soviet Union centred its disarmament policy on banning nuclear weapons and insisted on the use of nuclear energy for peaceful purposes, for the well-being of mankind–to raise the living standards and cultural level of the popular masses, to expand the energy basis, Soviet representatives in various international bodies stated that the use of atomic weapons was incompatible with the conscience and honour of the peoples. They proposed to conclude an international agreement to ban nuclear weapons and to use fissionable materials exclusively for peaceful purposes and to set up strict international control to ensure that all governments abide by this agreement.

The United Statec, which was the sole possessor of atomic weapons in the first few years after World War II, was conducting a disarmament policy which was diametrically opposed to the USSR's efforts. Pursuing their plans of political expansion and in fact aiming at world domination with the help of atomic weapons, the USA were striving to preserve and use in their policies their monopoly in nuclear weapons. At the same time, under the pressure of public opinion urging the ban of nuclear weapons, the US government was trying to appear willing to remove nuclear weapons from national arsenals. The US government declared its willingness to conclude an international agreement banning such weapons although in reality the US was doing all it could to prevent this. The United States also did its best to maintain a screen of secrecy around scientific discoveries in the field of atomic energy use.

The United Nations Atomic Commission became the stage of sharp political struggle. The United States presented the so-called "Baruch Plan" to the Commission which was in fact aimed at legally fixing the US monopoly in nuclear arms. In contrast to the American plan, the Soviet Union submitted on June 19, 1946 a draft convention to the UN Atomic Commission. This draft convention stipulated a complete and unconditional ban on the production and use of atomic weapons. The main idea of the dodoment included an obligation by participants not to use atomic weapons under any circumstances, to ban their production and storage, and to destroy all nuclear arsenals and weapons in the production stage three months after the convention became effective. The violation of the convention was to be regarded as "a most serious international crime against humanity". Simultaneous to the presentation of the draft convention concerning the ban of nuclear wapons, the Soviet Union submitted a proposal regarding ways of ensuring that atomic energy was used exclusively for peaceful purpose and that the conditions of this international convention were strictly observed.

This Soviet proposal was welcomed and supported by progressive public opinion in all countries including those in the West. The Association of Scientific Workers in Great Britain said in its memorandum:"Such a convention appears most desirable and it is difficult to justify the unwillingness of Great Britain and the USA to accept it".[3]

Their unwillingness was easily explained: neither the USA nor Great Britain had the slightest intention of renouncing nuclear weapons; they were making plans to use these weapons against the USSR and the socialist revolution. Winston Churchill openly admitted this at Fulton in March 1946.

An American state document known as the "Clifford Memorandum" was recently made public. Back in September 1946 the document formulated US political strategy in relation to the Soviet Union. This strategy stipulated limiting the international influence of the USSR and suppressing the peoples' liberation struggle. A large-scale war against the Soviet state was recommended to achieve this goal. In the words of the document,

> *"... the United States must be prepared to wage atomic and biological warfare".*[4]

It comes as no surprise then that, in such conditions, the activity of the Atomic Commission proved fruitless...

The United States and its allies Britain, France and other Western nations were moving farther and farther away from a policy of peaceful cooperation with the socialist countries and efforts to seek peaceful settlement of controversial political issues. They chose to pursue the notorious "strong-arm" policy based on the threat of using armed forces equipped with atomic weapons. The Western powers concentrated their efforts on setting up aggressive military blocs such as NATO and SEATO and unleashed a frantic arms race. The US concentrated on stockpiling nuclear weapons while openly declaring its intention to use such weapons under certain circumstances. During the Korean war influential US circles urged the use of atomic weapons against the North Korean armed forces and Chinese volunteers.

However these plans were not to be realized. The international situation had changed. An important factor responsible for the new situation was the loss by the US of their atomic weapons monopoly by the end of the 1940s. On September 25, 1949, in the Soviet Union, a TASS report was published which said the Soviet Union had discovered the secret of atomic weapons and now possessed such weapons.[5]

These remarkable achievements of Soviet science and technology, particularly in the field of nuclear and thermonuclear energy, signified the end of a most complex and dangerous period in international politics, during which the United States pursued aggressive policies based on its monopoly of nuclear weapons and attempted to impose its will on many countries and peoples throughout the world...

After the Soviet Union had invented the atomic, and later the hydrogen bomb, the disarmament talks entered their *second stage.* Whereas earlier some people could claim that the USSR was striving to ban atomic weapons because she did not possess any, now such arguments held no water. On the contrary, H-bomb tests were carried out in the Soviet Union prior to such tests in the USA. The situation had changed but the Soviet Union continued to work for disarmament. Alongside measures of general political character aimed at improving the international situation, the Soviet government worked out, and submitted to the UN Disarmament Commission, very important proposals concerning arms limitations, the ban on nuclear weapons and removal of the threat of new war. (May 10, 1955).

After the war had come to an end, for a number of years from the beginning of the disarmament talks right up to 1952/1954, the USA afd her allies had not made any proposals concerning the heart of the disarmament problem. They restricted themselves to making suggestions regarding measures of inspection and collecting data on the armaments. But with the loss of the United States' nuclear monopoly the situation had somewhat changed. The USA, Britain and France did come up with certain proposals in what came to be known as the Anglo-French Memorandum of July 11, 1954...

The Western powers, as a precondition for disarmament, urged first of all the creation of an "atmosphere of trust" and linked disarmament measures to the settlement of other international problems. This Western stand was taken into account in the new Soviet proposals. They envisaged the solution to a whole range of general political issues: termination of propaganda urging to war and fomenting hostility among nations, withdrawal of occupation forces from Germany, liquidation of military bases on foreign territories, spreading of scientific and technological know-how in the field of production and harnessing of atomic energy for peaceful purposes, settlement of unresolved problems in the Far East, eradication of discrimination in economic relations among states, expansion of international contacts and links in various fields, etc. The realization of these measures was aimed at strengthening international mutual trust and thus facilitating disarmament.

With regard to the disarmament issue as such, the West rejected the Soviet proposal to cut down the strength of armed forces and arms of the five nations by one-third, arguing that such a reduction would allegedly fail to provide security for the West. Theay insisted that troop reductions be executed not by one or another part of the total number but down to a certain numerical strength. In the wording of the document submitted by the three powers,

> *"All armament programmes depend on manpower and therefore must to a greater or less degree be affected by limitations on permitted armed forces".*[6]

In its new proposals announced May 10, 1955, the Soviet Union agreed in this matter, too, to meet the stand of the Western powers halfway. The USSR proposed reducing, in the course of two years, the number of men in the armed forces of the USA, USSR and China down to 1–1.5 million in each country and to 650,000 in Britain and France. These were the levels which the Western powers themselves had suggested. By this step the Soviet Union deprived Western propaganda of its argument that the Soviet Union was allegedly "ignoring the problem of parity" in relation to armed forces. This also made another favourite argument of the Western powers invalid, namely that nuclear arms should not be banned because they allegedly "compensate" for the Soviet Union's lead in conventional arms and serve as a means of balance in the field of armaments on the world-wide scale.

The Soviet Union also made concessions to the West in other matters related to disarmament. In their proposals of May 28, 1952 the Western powers established a direct link between the realization of the program of conventional arms reduction and the ban on nuclear weapons. They provided for such weapons to be banned in stages and linked this directly to a program of conventional arms reduction. In order to facilitate the success of disarmament talks the same procedure for banning nuclear weapons was envisaged in the Soviet proposals of May 10, 1955.

The questions of control-inspection over disarmament were also worked out by the Soviet Union taking into consideration the Western position. The representatives of the Western powers insisted that inspection be executed on a permanent basis and that international inspectors be given the right "of unlimited access to all installations and facilities in so far as this is necessary for them to carry out their duties and functions effectively". The Soviet proposals of May 10, 1955, envisaged that inspection should be carried out on a permanent basis and to the degree necessary for fulfilling the agreement on disarmament and that inspectors should be given unimpeded access at all times to all facilities under control...

Upon the request of the Western powers the talks were discontinued. When the talks were resumed after a long break, the USA and other Western powers withdrew their own proposals on disarmament, i.e. concerning the strength of troops and procedures and conditions for banning nuclear weapons. This action manifestly proved that the Western proposals had been made for propaganda purposes and not with the sincere intention of finding solutions to disarmament and other problems. Recently the British Association for the United Nations published a brochure entitled "Arms and Man" from which I quote:

> *"In 1955 Khrushchev accepted the Anglo-French Memorandum prepared by Mr. Selwyn Lloyd and Monsieur Jules Moch as the basis for the negotiation on a general disarmament traty. But the West speadily withdrew their proposals..."*[7]

These steps clearly showed who was a really in favour of disarmament and who was engaged in an arms race while spouting empty phrases on disarmament.

The opponents of disarmament at that time based their calculations firstly on the hope that the West, with its technological and industrial might, would be assured of a decisive quantitative and qualitative lead in arms over the Soviet Union and, secondly, that the Soviet economy would not be able to stand the competition in the area of weapons. This idea was formulated as follows:

> *"The arms race will break the backbone of the Soviet economy".*

Under these circumstances it is understandable why the further talks held in 1957/58 in the Sub-committee on Disarmament and in other United Nations bodies failed to assure any progress.

The third stage in disarmament talks covers the sixties and is characterized by those against disarmament having once more to concede failure and frustration of their hopes; they failed to achieve superiority in military technology over the Soviet Union: the Soviet economy withstood the test imposed on it. Continuing the arms race became to a large extent pointless for the imperialist countries. Moreover, the arms race was creating growing internal political problems. The working people in these countries were increasingly insistent in their demands for a cut-back in arms expenditure and utilization of the resources for solving internal social problems. This new development led the West to accept some of the Soviet proposals which resulted in small but doubtless useful steps towards disarmament.

In 1959, upon the initiative of the USSR, the United Nations adopted a resolution approving the idea of general and complete disarmament (the USA was co-author of the resolution with the Soviet Union). This resolution adopted on November 20, 1959, was of prime importance. It was the first time that the UN, with the consensus of all of its members, had outlined a clear target–general and complete disarmament–and called on all states to reach this goal as soon as possible. This signified support for those in favour of disarmament and to some extent made it more difficult for their opponents to continue evading the issue.

The first practical answer to this appeal was again given by the Soviet Union. On January 15, 1960, following the proposal of the Soviet government, the Supreme Soviet of the U.S.S.R. took a decision to further reduce the number of personnel in the Soviet armed forces by 1,2 million men, i.e. by one-third of its strength at that time.

The Soviet Union took particular pains to explain its position concerning international control over disarmament very carefully. This was necessary because the opponents of disarmament, while not daring to openly reject the Soviet proposals on general and complete disarmament, tried to sap confidence in these proposals by alleging that the Soviet Union proposed disarmament without inspection and intended to cheat the West by persuading it to undertake unilateral disarmament. Such allegations were forthcoming not only from the reactionary press but also from the US and other Western leaders.

In reality, however, the Soviet program of general and complete disarmament submitted for consideration by the UN General Assembly on September 18, 1959, stated quite clearly that measures of general and complete disarmament should be implemented with inspection and control being exercised by a special control body consisting of representatives from all countries. The extent of control and inspection should correspond to the particular stage reached in gradual disarmament by the states, in other words only those measures of disarmament being undertaken at a given moment would be subject to control and inspection. At the same time the Soviet proposals emphasized that the international control body "should possess all material facilities necessary for exercising strict control".

In explaining once again the Soviet Union's position on this issue, the Soviet representative, V. A. Zorin, said in his speech made on October 19, 1960 before the Political Committee of the XV session of the UN General Assembly:

> *"As early as the first stage of general and complete disarmament we propose establishing on-the-spot international control over the liquidation of all means of delivering nuclear weapons, including the most modern missiles. Similarly we further propose sending teams of international observers to military bases and troop stations located on foreign territory in order to exercise inspection over the dismantling of such bases and withdrawal of troops back to their own countries. We also propose setting up control at airports and sea-ports to prevent the use of these for military purposes. We propose setting up on-the-spot inspection at all enterprises, factories, plants and shipyards intended to produce rockets, aircraft and other means of delivering atomic weapons. We are prepared to reach agreement on setting*

> *up permanent inspection teams at some enterprises and plants. International observer teams will have the right to carry out general inspection of rockets launched for peaceful scientific purposes and to be present during launchings. International inspectors shall have unlimited access to state documents related to budget appropriations for military purposes. We finally propose exercising the measures necessary for controlling the disbandment of armed forces and destruction of conventional weapons.*
>
> *We propose organising just as efficient control over the second and third stages of disarmament. At the same time we propose, after general and complete disarmament has been finished, continuing permanent inspection in order to ensure that no country resumes arms production and formation of armed forces. We believe this to be entirely sufficient."*

Of prime importance in Soviet policy were and are its efforts to bring about an end to test explosions of A- and H-bombs. This is one long story of persistent struggle by the Soviet Union to save the world from experimental testing of nuclear weapons because these tests pollute the atmosphere, soil and waters of our planet and encourage the perfection of mass extermination weapons and intensify the nuclear arms race.

In 1963 (July 16–25) representatives from the governments of the U.S.S.R., USA and Great Britain met in Moscow for talks. In the course of these negotiations the text of a treaty proposed by the Soviet Union was worked out and initiated. On August 5 of the same year the Treaty Banning Nuclear Weapons Tests in the Atmosphere, in Outer Space and Under Water was signed in the Soviet capital by the Soviet Union, the United States and Great Britain.

The parties to the Treaty, which came to be known as the "Moscow Treaty", pledged to "ban and prevent and not to undertake any test explosions of nuclear weapons or any other nuclear tests in the atmosphere and outside it, including outer space, as well as underwater and in all other media, if such explosions could cause radio-active fallout outside the frontiers of the state in question". In the course of the two months that followed over a hundred nations signed the Moscow Treaty.

Although fully aware that the Nuclear Test Ban Treaty cold not in itself stop the arms race and would not alleviate or even markedly reduce the danger of nuclear war, the Soviet government did, however, realise the great international importance of such a treaty. The treaty not only saved people from radio-active fallout but was also an important step towards creating conditions which made it easier for the states to settle other controversies through negotiations. On October 17, 1963 as a result of talks between the Soviet Union and United States the UN General Assembly adopted a special resolution welcoming the intention of the U.S.S.R. and USA "not to station nuclear or other weapons of mass destruction in outer space" and called on all states to refrain from placing them in space.

The international Treaty on the Non-Proliferation of Nuclear Weapons was one of the major goals of Soviet disarmament policy during recent years. At the XVIII and XIX sessions of the UN General Assembly and before the 18-Nation

Committee in 1964 the Soviet Union repeatedly proposed proposed that an agreement be concluded on the nonproliferation of nuclear weapons, stressing the inadmissibility of supplying such weapons either directly or through military alliances to states not possessing them...

On June 12, the UN General Assembly endorsed by 95 votes to 4 (with 21 abstentions) the Draft Treaty on the Non-Proliferation of Nuclear Weapons presented to the 18-Nation Committee as a result of suggestions made by the Soviet Union and the United States. The General Assembly expressed the hope that more countries would become party to the treaty, both nuclear and non-nuclear nations...

The essence of this international treaty was that it unconditionally banned the supplying, directly or indirectly, of nuclear weapons to other countries or placing control over nuclear weapons in the hands of other countries. Nuclear weapons were banned from being supplied to "anyone", be they individual non-nuclear nations or military alliances. In a little over 18 months the Treaty was signed by nearly one hundred states.

On April 23, 1970 the Geneva Disarmament Committee received a draft treaty banning the placement of nuclear and other mass-extermination weapons on the sea-bed. The draft had been previously agreed upon by a number of countries. The Soviet Union and United States were co-authors of the document. The agreed text of the draft treaty was submitted by the Committee to the XXV session of the UN General Assembly and approved on December 16, 1970.

The XXIV Congress of the Communist Party of the Soviet Union held in March–April 1971 once again confirmed the Soviet Union's resolve to continue to work for disarmament. The Congress endorsed the Soviet foreign policy program which presents a wide range of quite realizable measures designed to slow down the arms race and reduce international tension. This program covers not one or two years but a longer period. From this follows that the Soviet Union puts forward individual proposals in a certain order and draws the attention of other countries above all to the most pressing problems whose solution may facilitate further steps towards disarmament and the switching of resources from military to peaceful spending.

In the summer of 1971 the Soviet government proposed to hold a conference of the five nuclear powers who bear special responsibility for maintaining international security. Who else but those states, which have created and stockpiled nuclear arsenals, should solve the matter of their being banned and destroyed? In the final analysis it is on the good will of nuclear powers that the cessation of the fateful arms race depends.

The development of events in the world makes it imperative that all countries, whether nuclear or non-nuclear, large or small, redouble their efforts to reach a solution to the disarmament issue. The new Soviet proposal to hold a World Disarmament Conference is intended to serve this noble aim which is in the interest of the entire world community of nations. The proposed conference could become a forum at which all nations, without exception, could jointly consider disarmament problems in all their entirety and attempt to seek practically attainable and universally acceptable ways of solving them. All states, whether members of the UNO or not, must be given the right to participate in this conference. The truly universal character of this conference is a must if this important initiative in the field of disarmament is to be a success. It goes without saying that all the militarily important nations should participate in this conference.

In the opinion of the Soviet Union, the World Conference on Disarmament could discuss the entire range of disarmament problems related both to nuclear and conventional arms. These include the problems of general and complete disarmament as well as partial measures to reduce international tension and slow down the arms race, such as the ban on chemical warfare, the cessation of nuclear tests including those underground, the creation of nuclear-free zones in various parts of the world, the reduction of military expenditure of all nations, above all of the big powers, and other matters. Considering that the nuclear arms race is the greatest source of concern of the peoples, matters related to banning and destroying nuclear weapons could be given top priority... Seen from this angle the Soviet proposals to call a meeting of these powers and a world disarmament conference logically complement one another.

All Soviet proposals and initiatives in the field of disarmament have one thing in common. They are intended for practical implementation.

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[1] V. I. Lenin, Collected Works, Moscow 1964, Vol. 23, p. 95.

[2] Arms and Man, London 1971, p. 3.

[3] Retranslated.

[4] A. Krook, Memoirs, N. Y. 1968, p. 478.

[5] Izvestia, Sept. 25, 1949.

[6] UN Document DC/10, May 28, 1952.

[7] Arms and Man, London 1971, pp. 8–9.

Several Reflections on B and C Weapons

E. von Weizsäcker, FRG

The fact that far-reaching agreement on the destruction of B weapon stockpiles has been reached at the Geneva disarmament conference and that great unanimity is expected to be reached on the same subject at the current UN General Assembly, has given rise to an understandable, though not fully justifiable feeling of relief. A great number of *problems* with regard to B and C weapons still remain unsolved, some of which cannot be solved by way of negotiations.

The international decision to destroy B weapons by no means guarantees that all stockpiles will be destroyed. China is unlikely to bother very much about this decision. Although all other countries may destroy any potentially existing stocks, there will be no absolute guarantee that this has been carried out completely. Even a government prepared to destroy its stockpiles completely might sometimes be unable to guarantee that this is executed properly and thoroughly.

Technical know-how on production remains in existence and will even tend to increase considerably along with further developments in microbiology and hygiene. For example, the cultivation of small quantities of viruses, suitable as B weapons, will inevitably be continued for use as vaccines and in medical research. Increasing production of these agents to quantities suitable for use in warfare can be effected within a few days.

It is even difficult to make sure that the ban on using such weapons is observed. In the situations of famine and pollution existing in a future world, the deployment of small quantities of infectious germs causing "natural diseases" might possibly be the most effective use of B weapons. It would be extremely difficult to distinguish the effects from naturally occurring epidemics, and the causes could never be conclusively proven.

Separating C weapons from the complex of BC weapons was probably necessary to make it possible to reach agreement on at least one issue. From the military point of view, however, separating them in this way is irrational and dangerous: C weapons, which are hardly less dangerous than B weapons and which are available in large quantities in East and West, could mean the resumption of almost all disarmament problems from the very beginning again.

Tasks

Following the agreement reached in Geneva, important tasks arising from these issues remain to be dealt with by scientist, technicians and pojiticians. I would like to summarize several ideas laid down by our working group in the volume "BC Weapons and Peace Policy" (published as volume 5 in the series "Studies on Peace Research", Klett, Stuttgart, and Kösel, Munich, 1970, edited by E. v. Weizsäcker).

One of the prerequirements for guaranteeing fairly effective control over the destruction of B-weapon stockpiles as well as over any new production capabilities in state-run or privately run industrial laboratories, is for all the scientists and technicians engaged in these laboratories to show a readiness to cooperate with one another. This readiness should be oriented towards peace and internationalism and should, if need be, disregard the short-sighted "interests" of one's own state, or particular political bloc.

All research, without exception, carried out in fields related to BC weapons should be made public, i.e. not shrouded in secrecy. Economic and political objections raised against this have been taken into account in the above-mentioned book.

For the sake of consolidating international loyalty to peace among scientists it is proposed that every scientist and technician employed in this dangerous field should have the right (and later even the obligation) to take part once a year in a congress that exceeds the boundaries of his political bloc. As a rule, the nature of these meetings can and will be purely scientific, although experience shows that these meetings would probably exercise a strong and profile-shaping influence on individuals through personal contact which would correct the fictitious enemy image and enable joint efforts for common aims to be built up. The threat to the environment with which microbiologists and chemists are especially concerned, is a topical subject in which there are common aims to pursue.

In the near future it is proposed to establish an institute, say under WHO control, which deals with documentation, evaluation and scientific processing of the issues related to BC weapons. Its results and research findings would be made public. The institute would do away with the often imaginary viewpoint held by many smaller states that they must maintain their own "defence research". In addition, many an intelligence service would become superfluous.

Since in the forseeable future we will have to live with the menace emanating from concealed B weapons and semi-concealed C weapons and since these weapons have been extremely well "tailored" to fit the internal and external day-to-day conflicts (much better than A weapons), we must considerably intensify our peace-propaganda campaign in all countries. It would be naive to confine this exclusively to scientists and politicians. The strongest obstacle to pushing through this education to peace is nowadays the widespread problem of „blinkered specialists" who know practically all there is to know about their own field of science, but who understand precious little about their fellow-men and society. In our book cited above there is a chapter by Elisabeth Throm on the possibilities of educating people to peace which deals with the problems of BC weapons as well as the problem of „blinkered specialists''. Another chapter by the physician Niels Thomsen indicates the almost insurmountable difficulties, arising from the present-day conveyor-belt system, which face adult peace education.

Responsibility of Scientists

Stimulating the Work of National and International Organizations and Cooperation for Common Aims

P. Biquard, France

We are approaching the end of our deliberations, in the course of which many specialized reports and papers on the subject of this conference have been delivered and have confronted us with the terrible realities of our age: the unrestrained arms race, the "overkill" potential the continuing Vietnam war, which is an example of the way in which science and technology can be perverted, to name but a few. The different papers informed us about the course of diasarmament negotiations, which, as Monsieur Jules Moch has said, commenced almost 35 centuries ago, and about the stage they have reached so far. What we have heard could make us lose hope, but on the contrary, the more complicated and urgent thetasks, the more determined we are to tackle them.

I am convinced that no-one here at this conference has not been fully aware of the urgency of this task for a long time now; that is why they have reflected on it and have been striving actively for disarmament. What is the use of this conference then? It is justified by the fact that the public knows it is being held, and that it is drawing their attention to the problems mentioned.

Many people ask themselves "What is to be done?", their question can be answered by Lenin: "Organize, organize and organize again!" This demand is just as valid now as it was before, regardless of whether it concerns individuals or groups that have already been formed... It seems to me that the action necessary from scientists would be more effective when carried out within the framework of organizations. This would above all also answer Professor Calegero's question: "How can a scientist limit his activities and participation in public life without at the same time diminishing the impact of his work?"

Since this conference has been organized by the World Federation of Scientific Workers I should like first of all to quote a passage from the preface written by J. D. Bernal in 1947 for our first pamphlet:

> *„The example of the Federation of American Scientists in calling attention to the implications of the atom bomb is one which needs to be followed in a coordinated manner by scientists throughout the world. We recognize that to-day the short and long term effects of scientific advances cannot be appreciated without a far fuller understanding on the part of the scientists of the political and social environment in which they work, and on the part of the people at large, of the scientific and technical aspects of the new developments. This double recognition involve us in a campaign of both*

> *popular and self-education, and here the existence of the Federation, which can draw together the experience of many countries, should prove invaluable."*

These words written in 1947 are even more valid—not only for our Federation vtoday than ever before and this double obligation to educate ourselves as well as others seems, in my opinion, to define our twofold task just as it defines its extent and difficulties.

Let us ask ourselves this question within the Federation just as the representatives of other organizations are also asking themselves the same question.

Have our affiliated organizations and their individual members sufficiently and correctly fulfilled this twofold task? In view of the manifold and dangerous aspects of the arms race have we done everything we should have done to inform all our colleagues and every citizen of this?

I put this question to our organizations in all countries irrespective of the political and social order existing there.

But it is not just a question of informing people. To do this is one thing but above all one has to call people to action, to organize them and to develop their campaigns. To do this we have to be convinced that there is an *obligation* to be fulfilled and of the effectiveness of our action...

Many national and international organizations are interested in the problems which have brought us together here. This is proved by the number of representatives from different organizations, associations, movements and federations gathered together here in this room.

Collaboration between scientists' organizations and other organizations can be desirable and can prove to be very efficient, especially when the problems raised contain scientific and technical aspects for which scientists possess the specialized knowledge. In addition to exchanging documented material and information it would also be possible for joint campaigns with specific, limited aims to be carried out. A joint campaign of this nature can only be effective if it takes into consideration the peculiarities of each organization in question and if it is carried out under mutual respect of these peculiarities. Let us take a look at one example concerning disarmament: The Permanent Committee of Non-governmental Organizations for Disarmament is preparing an international conference to be held next year. The non-governmental organizations which have already taken part in the preparatory meetings in Geneva each have a different structure and social composition and pursue very different general aims. But they have realized that in order to further the common cause of disarmament, it would be useful to convene a joint international conference which would be able to exercise an influence, not to be underestimated, on international governmental organizations, on governments and on the public at large. They are preparing this conference together with clear notions, within a fixed framework, with a fixed programme and with a fixed schedule. This does not mean, however, that any of the non-governmental organizations loses its identity or changes its course which often differs greatly from that of the other organizations participating in the joint project. If this project becomes reality, each individual organization will unquestionably profit from it, and the worldwide campaign for general and complete disarmament under strict international control will, it is hoped, receive a strong stimulus.

The long history of development in science and technology and their application for the benefit, as well as for the downfall, of mankind is accompanied by emphatic warnings from great thinkers and all those who foresaw the dangers as well as advantages which existed earlier and more clearly than others. When in 1903 the Nobel Prize was handed over in Stockholm to Pierre Curie, he drew attention to the "danger which radioactivity can represent when in the hands of criminals who embroil the peoples in wars". Two decades later Rutherford expressed the wish that the way of freeing nuclear energy might only be discovered at a time when people has learned to live together in peace. In 1934, again in Stockholm and upon the same occasion as Pierre Curie, Frédéric Joliot (before the discovery of uranium fission) spoke about the possibility of chain reactions and their possible positive as well as disastrous consequences for mankind.

We all know that he, as well as Powell, Bernal and many others, spent a large part of his activities on opening the eyes of his colleagues and all people, calling upon them to act in defence of peace and to take steps to ensure that science be placed exclusively at the service of mankind. The example of these great scientists provides us with fresh hope and courage in our struggle for justice and peace.

In our struggle for disarmament in particular, we are involved in a struggle which we know from the very beginning will be hard and full of obstacles, but of imperative necessity. Yet we will continue along our path. Marie Curie used to refer to one of Pierre Curie's guiding principles to which he always remained true: "Continue with a task once started *come what may.*" I think we should make this guiding principle our own.

Standpoint and Tasks of Teachers and the Education of Future Scientists

E. Brumme, GDR

If the scientist has become aware of his responsibility towards society and bears this in mind during his work, then his work and its results largely depend on his position in and standpoint towards the society in which he finds himself and on the attitude of this society towards him. Thus, the question of interrelations between a scientist and the society in which he lives and works is important.

The society in which I live and work has given itself a constitution which states that science and research and the application of their results are the fundamentals of society and are promoted by it. Science and education are promoted with a view to protecting and enriching human life. Then it states verbatim:

> *"Any misuse of science directed against peace, international understanding, against the life and the dignity of man, is prohibited."*[1]

I embrace these principles and I am guided by them in my work as a teacher... The teacher's task is to educate and bring up. And he masters this task most effectively when he educates while bringing up. Just as we should take into account the close connection between education and upbringing, we should appreciate the unity of natural and social sciences and act accordingly in our profession.

We teachers bear a particularly important responsibility in this work. We must give our pupils a sound factual knowledge (in 12 subjects!) which they should be able to use; the unity of theory and practice must be maintained, theoretical foundation and generalization be taken into account, and finally, we attach great significance to practical application of the acquired skill and knowledge...

Considerable importance is attached to mathematics and natural sciences in our schools. The teacher must not only convey adequate factual knowledge, he must also teach his pupils how to learn, since the young man or woman, after leaving school and even more so after completing his or her university training, must be able to continue to learn without the guiding hand of a teacher or professor, and frequently even to teach if the young citizen is to meet the requirements of society as a member of society.

The time devoted to instruction for the 11th form (11th school year) is subdivided in the following manner at the school in which I work:

for mathematics	20 per cent

for physics, biology, chemistry	23 per cent
for practical technical work	11 per cent.

This means that 54 per cent of the instruction time available each week are devoted to teaching mathematics, natural sciences and to technical training. As a physics, biology or chemistry master, the teacher is a natural scientist, while as a pedagogue he is a social scientist. Those who see this as a contradiction will not be able to solve the problem contained therein.

Most of the pupils of our school show a deep interest in mathematics and natural sciences. A large percentage of our pupils study mathematics or a natural science after completing secondary school. Quite frequently our pupils try to prove various laws of social sciences with the aid of mathematics and formal logic. If they do not succeed, they often conclude that there are no laws governing social development since one is unable to prove them. But this only proves that social laws cannot be solved with the inadequate means used. Some of our pupils who do not understand this and who do not use the methods of modern dialectis, etc., tend to downgrade the role of social sciences. They, as future natural scientists, feel superior to future social scientists. If the teacher does not constantly bear this in mind, this may cause pupils versed primarily in mathematics and natural sciences to develop feelings of belonging to an elite group and of being superior to other sciences and scientists. In this question each teacher should concentrate on bringing this pedagogic skills to bear, since only in this way can he meet his responsibility towards young people and towards society as a whole.

The curricula and text-books used in our schools are of great help to the teacher. I should like to illustrate this by an example. I confine myself to biology, chemistry and physics. The biology curriculum at the extended secondary schools for the 11th and 12th forms states in part:

> *"In view of the development of biology and of the demands our society makes on the education and training of our young people, our schools must above all give the pupils a profound insight into the essence of life. They must gain an understanding of the basic processes of life on the molecular level, so that they may understand the biological processes in their inherent connection. Pupils must comprehend the close connections between biology, chemistry and physics as well as between living nature and society. The object of this is to give the pupils an understanding of the general laws governing living matter, and of the interrelations between living and non-living matter and society . . . The pupils must be shown how progress is being made in biological science and how theory is developing as a result, so that they will realize the process nature of scientific cognition. In the process of showing them the relations between biology and society, special attention must be given to the utilization of the results of biological research for improving man's living conditions, and for solving important problems of the scientific and technological revolution, not neglecting, however, to point out the abuse of such results for criminal, antihuman purposes."*[2]

The biology text-book for the 10th form states in its chapter on "The Significance of Mutation for Living Organisms":

> *"Mutations are caused not only by natural influences. The terrible direct effects of radioactive radiation on living organisms are known... from the atomic bombs dropped over Hiroshima and Nagasaki. They have also been observed following accidents when handling radioactive substances... Apart from stringent measures to prevent radiation damage it is also necessary to investigate the wide range of chemicals used by civilized man in his food, in medicines, in cosmetics and in industry for possible mutagenic effects in order to prevent genetic damages."*[3]

A chapter on phenols in the chemistry text-book for the 9th form contains the following passage:

> *"The use of phenol during the fascist era in Germany is an example of how chemical products can be used for exterminating people... Thus antifascists and Jews were murdered by phenol injections administered by concentration camp doctors."*

The chapter on esters in the same text-book states among other things

> *"Other phosphoric acid esters belong to the most dangerous chemical warfare agents. Such agents known by the names of Sarin, Soman and Tabun were developed in fascist Germany. Poisoning with these chemical warfare agents results in serious damage to the nervous system as well as in heart and respiratory disorders. Even slight quantities of these phosphoric acid esters can be lethal. Abuse of these organic compounds as chemical warfare agents for destroying human life is contrary to international law and is to be sharply condemned."*[4]

And finally, allow me to quote another passage from the physics text-book for the 10th form. All our text-books contain questions that must be answered by the pupils. The questions clearly show how we are trying to educate and bring up our young people. Two questions of this type read:

"Discuss the attitude towards humanity of various scientists at the turn of the century." "Evaluate its significance for society." One of the passages in this section of the text-book reads:

> *"Following the crimes perpetrated in Hiroshima and Nagasaki in August 1945, Otto Hahn and other scientists protested time and again against the use of nuclear weapons. In April 1957, he signed the appeal of the 'Eighteen Atomic Physicists of Göttingen directed against participation in the production, testing or use of nuclear weapons. F. Joliot-Curie, Hahn, Einstein and other physicists realized that natural scientific research work always has immanent consequences for the life of society. This gives rise to the inescapable political responsibility borne by natural scientists for the use of research results. Einstein, an eminent modern physicist, confirmed this responsibility in one of his messages:*
>
> *'We scientists, who have unleashed this mighty force, bear the great responsibility for channelling atomic energy in such a way that it is used for man's welfare and not for his destruction.'"*[5]

Summing up let me say that the dangers emanating from ABC weapons are acute despite the fact that real possibilities of disarmament may be realized in the not too distant future, and despite the fact that there are already numerous scientists who are aware of their responsibility towards society; we must not regard education and upbringing of our young generation in an irresponsible and unconcerned manner. The responsibility of teachers towards society is so important because they are educating and training all future scientists in our schools colleges and universities. All projects, all plans are elaborated by us, the people, and implemented by the people. Our personal engagement cannot be too great!

[1] Constitution of the German Democratic Republic, Staatsverlag der DDR, Berlin, 1968

[2] Lehrplan für Biologie, Erweiterte Oberschule, Klassen 11 und 12 (Curriculum for biology, extended secondary school, 11th and 12th forms), Volk und Wissen Volkseigener Verlag Berlin, 1968

[3] Biologie, Lehrbuch für Klasse 10 (Biology, text-book for the 10th form), Volk und Wissen Volkseigener Verlag Berlin, 1971

[4] Chemie, Lehrbuch für Klasse 9 (Chemistry, text-book for the 9th form), Volk und Wissen Volkseigener Verlag Berlin, 1970

[5] Physik, Lehrbuch für die Klasse 10 (Physics, text-book for the 10th form), Volk und Wissen Volkseigener Verlag Berlin, 1971.

Educating Young Scientists to Be Responsible to Human Society

G. Buchta, GDR

Robert Oppenheimer after the Bomb had been dropped on Hiroshima and Nagasaki:

> *"I was inspired by the deepest interest in my science, but I was unaware of the relation between man and his society."*

His teacher Max Born:

> *"It is nice to have praised such clever and competent pupils but still I wished that they were more wise and less clever. It is certainly an error on my part if they learned only the methods of research from me and nothing else."*

This is the legacy of a generation of natural scientists, a legacy that they painfully learned, perceived and made known to coming generations. It is the duty of those living today to preserve this legacy and to train scientists from the first day of their study to be conscious of their position in society and have the ability to assume their responsibility of contributing to a happy future for mankind. The social responsibility of the scientist is being defined, discussed and demonstrated at this conference. I am too young to be able to refer to such experiences myself and it is uncertain what importance my scientific work will one day have. Nevertheless, it is my wish to speak to you here and now.

I studied physics for three years at the Humboldt University in Berlin and am now beginning university research in the field of the theory of elementary particles. Even at a much younger age than I am now, names like Einstein, Born, Joliot-Curie greatly attracted me, as they doubtless attracted many young people in my generation. I took my school-leaving examination in a special class at the Humboldt University with an intensified training in mathematics and physics.

At school I read "Galileo" by Brecht, I read about the life of Albert Einstein, and went to see "The Case of Robert Oppenheimer" acted by the Berlin Ensemble. The problem of the scientist's social responsibility, its contradictoriness and urgency, were thus not unknown to me from the experiences of famous scientific figures when I began my physics course with enthusiasm and a thirst for knowledge.

These questions have not lost their attraction and significance for me in the past three and a half years. I can say with pride and joy that I have enjoyed an education which endowed me with greater clarity and insight into the problems of the social position and responsibility of science and the scientist just as it increased my scientific knowledge of physics in both width and depth. I would like to give you some idea of how it is made possible for and a duty of our students to learn more at university than just the methods of research. One of the demands which accompanied us through our entire course was to be responsible for what we do and not do, to justify it and substantiate it not only to ourselves but also to the other members of the study group, the seminar or the FDJ group (FDJ = Free German Youth—the organization of youth in the GDR). This is true, for example, of our academic results and our political attitudes and points of view . . .

This education to act consciously, not only in one's own personal interest but also in agreement with the collective in which one lives and works, as well as on the basis of the knowledge of and insight into the collective interests, I feel to be a characteristic feature of our study, without which our socialist society would not be conceivable at all.

It is an important experience for me to have seen that such a high personal aim, (unattainable for people of earlier centuries), namely, to behave purposefully and justifiably in society as a human being on the basis of having an insight into the laws of social development and thus to participate systematically in organizing it, is at the same time a decisive foundation in the successful development of our socialist country...

Our years at the university impart the experience needed not only to recognize our personal responsibility theoretically, but to actually assume it. New forms of study and new curricula have been worked out at our universities in the past years and many students took an active part in this. I myself helped in a group of scientists and students from the physics department to develop partially programmed teaching material on classical electrodynamics. As a result of these efforts an entirely new way of imparting and acquiring knowledge has been introduced for part of our training.

Part of the education to assume active responsibility also arises from the fact that students cooperate in working out curricula and teaching materials from which they themselves will no longer benefit. The word education here is meant to express the fact that by no means all the students who come to the university are willing to assume active responsibility and that responsible participation means new discussions and arguments every day. It is a long process which leads to recognition of the laws of social development which in turn allow the necessary personal daily deed for our state to grow... Every new day means a new test, means coming to grips again, means a new decision. It is to the great merit of our socialist youth organization that it calls forth this daily new decision for our state, for our social order in mutual education and responsibility among students, by enabling and organizing the students to take part in thinking and acting. Thus the Free German Youth has a respected place and has acquired comprehensive rights of co-determination in our universities. The FDJ has its elected representatives in all government bodies, starting from the technical sections in the departments up to the university administration and in the university councils...

Especially in the last years a fruitful community of teachers and students has come into being in so far as the teaching staff and students joined together to devote more attention to problems of education and training. Fruitful especially in the following sense: it is something quite invaluable and incomparable for us students to be called upon by a scientist, whom we greatly respect and admire, to follow not only his example in the field of science but also his own personal example in life and social activity, to join him in supporting the Vietnamese people and against US imperialism, in supporting Angela Davis against a system which makes such crimes possible. Such a scientist will also teach his students to come to grips with the experiences of history; he will teach them the possibilities and principles of our socialist countries and the dangers and humiliation which the imperialist countries have brought and are bringing over the people. He will tell us how natural scientists, who according to R. Oppenheimer "first learned sin" in the destruction of Hiroshima and Nagasaki, can prevent further sin, for this teacher will know that peace needs everyone's strength. We shall respect such a teacher not only as a specialist, we shall admire him as a personality. He will live on in us when we later tell students that we have grown up in a state which, along with our scientific knowledge, gave us an insight into the laws of society and thus spared us the confusion and tragedy of the socially conscious scientist in an imperialist country, for our country has made the mission of science–to make human life easier and to enrich it–its own mission.

How Scientists can Influence Public Opinion

F. Calogero, Italy

Scientists undoubtedly affect in a very significant way public opinion at large; mostly, I believe, inadvertently; mostly, I submit, for the best. For they contribute, by their very existence, to the reaffirmation and spread of the values associated with free enquiry, a critical mind, "reason". This is a trivial observation; it is, nonetheless, true. And we should not allow ourselves to underestimate such simple truths, as long as the opposite values–bigotry, fanaticism, ignorance –are rampant and world-wide.

None of us is, of course, so starry-eyed as to believe that the set of values associated with the pursuit of science are all good, that their influence on society and culture is only for the best, that scientists are inherently champions of virtue and integrity. Indeed, in advanced technological societies the current disenchantment with these values is undoubtedly well justified. Neither would I discourage the harshest criticism of the naive optimism that is implicit in the use of the term "progress" to characterize any novel scientific and technological development.

But the fact remains, that, in an overall world-wide view–including Africa and Europe and India and North America and Latin America and China and so on–the impact of science on contemporary culture is, on balance, largely positive. This is an important point, for it justifies the opinion, to which many of us still sling, that striving to be a good scientist, and to uphold the traditional scientific values, constitutes a fundamentally valid rule of behavior. Better, of course, if such behavior be devoid of dogmatism and complacency, if it be seasoned with a considerable amount of self-questioning; for if, as I believe, it is a necessary condition to guarantee that our ethical standards are sound, it certainly does not provide a sufficient condition. Indeed, even the very statement that a correct scientific approach constitutes by itself a positive value is nowadays challenged, especially by the younger generation, including the younger generation of scientists.

Foremost among the scientific values is respect for the work of the fellow scientist, willingness to understand his results, relative indifference to many aspects of his personality that otherwise play such a dominant rôle in human affairs–like nationality, race, religion, even sex...

As regards public stances taken by scientists as such, they are most likely to influence public opinion and policy if they are taken by an overwhelming majority of the relevant scientists; if the matter has a sufficiently large share of purely technical content, to justify the scientists speaking, so to say, ex cathedra, to laymen and politicians; and if the scientific basis for the stance is sound. This latter condition should be viewed rather as a corollary of the first than as having independent validity. For if the stance has no sound scientific basis, quasi unanimity is certainly unattainable, and the case presented by dissenters may turn out to be equally, or even more, effective in influencing public opinion and policy. In fact, even few dissenters with a relatively shaky case can easily confuse matters sufficiently to convey to public opinion the impression that "the experts are in disagreement".

Thus, the conditions for an effective and useful public stance by scientists arise rather seldom; indeed they are most effective if they appear, to laymen and politicians, as rather exceptional events. The realization of this fact should induce in all of us considerable restraint when it comes to promoting, sponsoring or participating in such initiatives. Worthy as many causes are, the man, or the group, that becomes known as an easy joiner in the (vocal) fight for any good cause, soon finds his influence much weakened, if not altogether gone. Moreover, he is also, to some extent, weakening the possible influence of his colleagues for some time, in view of the very blurred power of resolution that public opinion has. Thus some restraint should be exercised, even though this often means refusing to join a public drive for some perfectly worthy cause... Quite different is the situation if the circumstances imply a measure of personal risk—as is unfortunately the case in many instances, in different parts of the world, where a scientist who speaks out may lose his job, or even worse.

Let me emphasize that the above considerations are not motivated by the "ivory tower" concept of the scientist, who should heed science and nothing else, and not engage in the "dirty" world of politics. I subscribe to the contrary view: scientists should engage in politics like any other citizen, indeed more because of the special rôle and responsibility that has been bestowed upon them by the central importance that scientific and technological development have taken in the world of our time. (With only one qualification, but of great practical relevance; that this engagement do not detract from the quality of their scientific work)...

As regards the convening of international conferences to discuss and agitate issues of ethico-political relevance, or the setting up of international organizations or loose groupings of scientists concerned with "Science and World Affairs", I submit that while these undertakings, if soundly conceived and managed, are generally fruitful, this is primarily because they provide a forum for the exchange of ideas among scientists, for the smoothing out of differences of opinion and of outlook, possibly for the development of new approaches to difficult political problems. The effect on public opinion is, on the other hand, generally a secondary effect, and in some cases it may even be complementary to the main purpose (I am using here the term "complementary" in the sense familiar from quantum theory, i.e. as imälying an element of mutual exclusiveness).

You probably recognize in this remark a reflection of my background as participant in several Pugwash conferences and symposia. In fact I believe that one of the reasons for the remarkable success of Pugwash has been and is due to its tradition of caution as regards relationships with the press and the other mass media. For the fact is, that very few people, especially if they bear official responsibilities, or are sufficiently close to the decision-making process in their own countries to be able to influence it, will ever discuss candidly matters of policy, unless they are reliably guaranteed that what they say has no chance whatsoever of being seized upon and utlized for propaganda purposes. On the other hand it is clear that a policy that, to foster maximum frankness in the exchange of ideas, is fordec, at least to some extent, to keep the press at arm's length is hardly compatible witht the aim of trying to influence public opinion to the maximum possible extent.

The contrast outlined here is perhaps more basic than it may have appeared from this analysis. Indeed it can be traced to the contradiction existing between the techniques that are more effective to influence public opinion—that favor oversimplification, sensationalism, the propaganda approach—and the values that lie instead at the very root of the scientific approach. Whenever we lament the lack of influence of scientists over public opinion—whenever we discuss schemes to increase this influence—whenever, in fact, we consider how scientists can influence public opinion; we should remind ourselves of this fundamental contradiction, that probably lies at the root of many of our frustrations in this field...

Many of the remarks I have voiced previously, having in mind activities in the international sphere, continue of course to be relevant in the national context. But perhaps one can now be more definite. In fact, allow me to refer to one instance in which I have been personally involved, using this very specific example as a basis for some considerations that I hope have a more general relevance.

When the text of the Treaty against the Proliferation of Nuclear Weapons (NPT) was finally agreed in Geneva and at the UN Assembly, and as the question of signing it came up, a great controversy and confusion broke out in several countries, including my own. Italy had been consistently and rather constructively in favor of the NPT throughout its long gestation, but this had happened without either public opinion or the political élite being interested or even aware of the problem, that was essentially handled as a routine matter by the appropriate diplomatic personnel. Rather suddenly, as the NPT was being finally agreed upon, the problem exploded in Italy, and for some time it became a central political issue. It is neither possible nor necessary to relate here in any detail the arguments for and against the Treaty that were put forward; but it is important to note that, largely because of the circumstances outlined above, the debate was characterized by considerable lack of information, indeed by widespread ignorance of the overall context, including both the strategical-military-political aspects and the technological-industrial implications; indeed I believe that essentially because of this the first reaction to the Treaty was a largely negative one. This situation provided a large opportunity for scientists (especially physicists) to intervene, both in a personal capacity, and by a collective stance; and, in my assessment, these interventions, that were aimed to influence both public opinion at large and the political élite, were quite effective. Several reasons contributed to this:

1 the fact that there were a few scientists who were reasonably knowledgeable about disarmament and arms control, who had followed the progress of the NPT, who were therefore ready to intervene immediately as the political controversy broke out, and who had enough political connections, personal prestige, and specific know-how, to be able to mount an effective campaign (writing or inspiring editorials, being interviewed, participating in public debates, being available for TV programs, having personal contacts with political leaders);

2 the fact that public opinion and politicians were mostly uninformed and innocent on the whole problem, thus likely to be easily swayed by irrational arguments, unless the voice of informed reason were strongly heard;

3 the fact that most scientists (especially physicists) were vaguely in favor of arms control and disarmament, even if they knew little about it, and therefore an overwhelming majority of them could be quickly summoned to come out in favor of the NPT;

4 the fact that the issue was at least partially technical, so that a stance by an overwhelming majority of the academic physicists was bound to influence strongly public opinion at large, and to a considerable extent also the political leaders; the more so, since that academic community was clearly not homogeneous ideologically and politically, and was not known as a group who had the easy habit of speaking out on public issues.

This analysis of the reasons that contributed to the success of the campaign of scientists in Italy in favor of the NPT suggests the need for scientists, even if only on a personal basis, to keep themselves knowledgeable and informed on disarmament and arms control (including the relevant context, i.e. armaments, the arms race, and the strategic arguments sorrounding it), and, of course, on other issues belonging to the relations between science and world affairs.) It indicates the danger inherent in a public opinion and a political élite that are quite unaware of the strategical, military and political realities and doctrines that characterize the contemporary international scene; because of this ignorance, and because of the great changes that nuclear weapons and other technological developments have produced, their reactions are likely to be motivated largely, if not mainly, by totally outmoded conventional wisdoms and by stale nationalistic myths. This analysis points primarily tot the need and usefulness of the self-education of scientists, and the education of the public at large and of the political élites, on the large body of facts and doctrines belonging to the growing sector of human affairs that are directly affected by science and technology. It is fortunate that these two aims–to educate oneselbes, and to inform public opinion–can be carried out concurrently; for there is no better way to educate oneself than by undertaking to educate others.

The question of the techniques to implement such a program is one that I certainly do not have the time to explore in any detail. I will only mention the scope that is open in institutions of higher learning, especially universities; and indeed note that in some countries, some progress in this direction is noticeable, in the introduction of lectures, courses and even complete curricula oriented towards issues of public relevance, such as "peace" or "development".

Suitable literature which assists these activities by making available authoritative and reliable information that would be otherwise difficult to collect for individual scientists, is most useful. Here a very important rôle is to be played by international and national organizations, both private and public. As outstanding examples of this type of contribution, one may quote the Reports commissioned by the Secretary General of the United Nations to international scientific panels composed of prominent scientists, and the work of several research institutes, among which, in the field of disarmament, special mention should be made of the Stockholm International Peace Research Institute (SIPRI).

In trying to summarize the remarks made in this paper, let me list the following points:

1 By their very existence, and by their very activity as scientific researchers, scientists influence public opinion at large towards a set of values that is largely positive: mutual understanding, reason, indifference to irrational myths, free enquiry. A related, very important, topic that should at least be mentioned here is the rôle played by science and by the scientific method in the whole educational system (the fact that an increasing number of people go through a formal educational process extending over an increasing portion of their formative years is a dominant characteristic of contemporary society throughout the world).

2 A very positive influence flows from all scientific activities that extend across national boundaries, especially if these activities are successful (from the purely functional point of view). Therefore all such activities–including exchange of scientific personnel, joint scientific projects, international conferences, the establishment of international professional associations, etc.–should be encouraged and actively supported.

3 A reasonable amount of restraint should be exercised in undertaking to organize or to join coordinated efforts by scientists to influence public opinion on some specific issue of political relevance, in view of the danger that their outcome be rather disappointing. This, however, in no way justifies the "ivory tower" concept of the scientist, who minds his own research, perhaps does it in the best possible way, but ignores totally the responsabilities that as a citizen, and especially as a scientist, he has towards society.

4 The convening of international conferences attended primarily by scientists, and/or the setting up of international groups composed mostly by scientists, and having the purpose to discuss and agitate matters of social and political relevance, may turn out to be more useful because of the opportunity they provide as a forum for the exchange of ideas, than because of the direct immediate impact on public opinion.

5 As regards the influence of scientists on policy and on public opinion in their own countries, we recommend a process of permanent self-education of scientists (both personally and collectively) and of widespread dissemination of information, relative to the new facts and ideas that are relevant to all areas lying between science and public affairs (facts and ideas that are easier for a scientist to grasp, but require nonetheless some homework). This activity provides the best basis for mounting a most effective political campaign on issues of special relevance, whenever the proper occasion arises. It is then possible, even for a tiny group of strongly motivated scientists, to exercise a very considerable sometimes pivotal, influence on public affairs.

Individualist or Collective Approach to the Problems of Disarmament

J. M. Legay, France

I am making my contribution as a delegate of the Syndicat National de l'Enseignement Superieur français (the French National Union of Teachers in Higher Education) in order to try to help in the attempt at greater clarification which has been undertaken during the course of this conference.

It seems to me that the approach of many of those who have contributed to the discussion of peace and disarmament contains a number of ambiguities. The quest for peace seems to me to imply two propositions:

(1) First a *decision* that can be considered as a *moral* one which consists in saying that we would like to resolve the problems which face us by peaceful means; it is on this basis that it is possible to condemn the production and use of ABC weapons. This objective is limited. Of course, even the choice of this objective is not the only one: one could resolve disagreements by force in the physical sense of the word–and one could, on the other hand, show that the opposite choice, the peaceful one, is not independent of the experience acquired by humanity in every field (technical, economic and political).

(2) The second proposition is the *determination of means* to reach this objective; two tendencies have become apparent here: the *individualist* one, which consists in underlining the personal responsibility of scientists. But why not also those of the workers employed in military production? The supporters of this tendency confuse, in my opinion, the objective and the means, and even extend the moral problem into the domain of means. To adopt this idealistic approach means accrediting scientific workers with a very special situation in society, not only because they contribute to the discovery and perfection of new weapons, but also because they have the power to act on the production and eventual use of ABC weapons. It is difficult not to see all the contradictions and the poor efficiency which are produced by the exclusively moral view of the responsibility of scientific workers.

The other tendency is *collective* and implies making this responsibility into an essentially political one; it rejects the view that purely technical solutions can lead to disarmament; besides all the papers presented to this conference have shown that control techniques always lag behind the production of new weapons. A materialist approach to our problem leads us to think that scientific workers, forming a social group within society, must act as a specific group but in close contact, of course, with the organization of other groups and in the first place with that of the working class wich is particularly interested in maintaining peace. It is not possible for scientific workers to act as if they were the only ones to want peace, even if, because of the information they possess, they have the best reasons to want to preserve it.

If I insist on the necessity of choosing a definite approach, it is not only to clarify our actions, but also to prepare our actions better. In fact, if you admit that the questions we have been descussing for three days are clearly political then it is necessary that the WFSW itself has an appropriate policy and that it gives itself the means corresponding to the policy that it chooses.

If our Federation chooses the idealistic approach to the problem of peace and disarmament, then its policy will be that of a group of more or less famous personalities on whom one could count to raise public interest on the occasion of scattered, anarchistic and sometimes startling actions. If our Federation chooses the collective way, then its policy will be really the policy of a federation. It will get support from its affiliated organizations, primarily the unions and will support and co-ordinate the action of national organizations, while taking into account the particular conditions in which they work, socio-cultural environment, etc...

Thus, if there is a war or preparation for war, it is not because wicked men, helped by bad scientists, have so decided. It is because the economic and political contradictions in a country or between several countries have become such that they lead necessarily to a crisis; it is because the balance of forces has been modified in such a way that no control is exercised on the ruling class of the country or countries in question. Thus disarmament cannot come except from a continuous struggle which involves the broadest possible sections of the people and which is inseparable from the struggle waged by the working class and its organizations for the transformation of society.

Within this perspective the individualist approach to the problem of disarmament seems to us historically to form a first stage corresponding to a small scinetific community without alliances and without any real effect in society. The collective approach leads to a second stage which is necessary and better adapted to the present number of scientific workers and their impact on modern society. The evolution of the scientific community does not render useless the first form which must now be complemented. The WFSW has the unique opportunity to be able to combine the two forms of struggle, the individual one, which could be appropriate to certain people and to certain socio-cultural conditions and the collective one which is necessarily that of the majority of scientific workers.

I am able, I believe, to commit our union on the following points:

> *On the level of objectives, we think that the problems which confront mankind today, however complex they may be, can be resolved peacefully.*

> *On the level of means, we choose the collective approach and we think that the policy of the WFSW must be to win all scientific workers for the struggle for peace and to contribute to the organization of this struggle.*

If many of those present have come to participate in this conference, it is not only because they attach *a great importance* to its subject, but also because they give *a political significance* to this subject and because they want to see our Federation raise its organization and its means to the level of the problems that it takes on.

The Position of the Scientist in the Struggle for Disarmament

G. Page, France

The existence of a developed trade union work among scientists and of a trade union movement, which is closely allied with the working class is a characteristic feature of the situation in France. This fact helps us to present the case of scientists in a clear manner but also to support it with the entire working class movement especially in those instances when their aspirations are of general interest...

We will try to refute certain arguments of a socio-economic nature, which are used by capitalist governments to justify the arms race and enormous financial expenditures which are like a bottomless pit.

Unlike in the past, when military research was stimulated particularly in times of war, when the entire intellectual and material potential of a country was mobilized to attain a superiority that would make it possible to defeat the enemy, the arms race has developed in an unprecedented manner since the Second World War. It has resulted in such extensive mobilization, or more correctly, in immobilization of the research potential that it has become a growing obstacle to meeting the social requirements of every country.

Scientific research in the military field has become a true plague of mankind. To conceal this fact, monopoly capital is unscrupulously propagating a number of pseudo-theories which we must unmask and refute: the balance of terror is the most reliable protection for peace, but it inevitably leads to the development of ABC weapons; a large portion of scientific progress has always been made in times of war, it would not be possible without the danger of being wiped out; even if military research and the resulting applications are useless, the influences they exert on civil economy justify the military expenditure; military research and the development of ABC weapons stimulate economy and create jobs and this is beneficial for the entire country... We would like to deal with some of these assumptions.

The theory, according to which war work brings about greatest scientific progress, is pure deception. First, we are a long way from using the entire scientific potential for peaceful purposes. Therefore a situation cannot be compared with one which does not yet exist at all.

It should be pointed out that since 1900, i. e. in the last 70 years, the average increase in current expenditures has been 5 per cent per year and in the last 20 years considerably more. These expenditures are 40 per cent higher than the expenditures of all countries for public education, they represent more than three times all expenditure for the health service.

Second, if this theory contained only a fraction of truth it would show that when means are made available for the development of the scientific potential they also bring results. Just this argument is rejected by the representatives of capital in order to justify the shortage of means for civilian research. Finally, from a purely historical point of view, the authors or champions of this pseudo-theory would have to prove which wars or which arms races led to the discovery of spectroscopic analyses (Kirchhoff-Bunsen 1859), the theoretical structure of chemical compounds (Kékulé 1858-1866), the theory of disease from microbes (Pasteur-Koch 1866-68), electromagnetism (Maxwell 1873), the discovery of radium (Curie 1898) and electrons (Thomson 1897) or the quantum theory (Planck 1900) and the special theory of relativity (Einstein 1905), to name only a few examples from this historical epoch.

There can be no doubt that a serious investigation would show how greatly the credulity of the public is misused. Because the diesel engine was developed for submarines or because the process for winding up the finest wire or chemical processing, supersonic welding and the explosion form process were developed for military purposes or space research and then found application in civilian industry, the champions of the arms race think they have proved this pseudo-theory by bringing on these examples. Unfortunately this method has a certain effect on the public—an effect which we must counter.

This takes us directly to the third point, about the "civilian effects of military research".

The experts of the Organization for Economic Cooperation and Development (OECD) concluded after an investigation of this problem:

> *"Despite these examples the products and techniques which directly go into the civil sector represent only a very small share of the entire scope of military and space research. In addition, because of the way that technical requirements in the military field and space research on the one side and in the civil sector on the other are diverging from each other more and more, the possibilities of application in this sector become ever smaller."*

Thus the secret civilian effects of military research not only show the degree of confusion organized by the capitalist governments, but to a certain extent nourish the campaign against science and its usefulness for society!

The most dangerous argument, with which it is claimed that scientific research oriented to modern weapons development (ABC weapons) ensures not only the defence of the country but also gives an upsurge to industry, has found a certain echo among the public. The arms race provides a considerable source of jobs in a capitalist world which is frequently threatened with unemployment, the development of ABC weapons always provides a "full order bock"; it creates and maintains a whole series of offshoots in industry and trade.

Under these conditions we must be concerned with suggesting solutions which take account of the problems of development in the economy and employment. For this reason we believe that the best answer to this argumentation lies in a policy of changing over from military activities to civilian activities.

This conversion would have to be directed not only at mobilizing material resources for peaceful production but transferring all working people to civil spheres without any loss in earnings or a worsening of working conditions. There is a limit, however, which it would be utopian to disregard. The present international situation unfortunately does not permit considering complete disarmament. A minimum of labour expenditure in the interest on national defence must consequently be conceded.

From this angle technical development in the field of armament exclusively necessary for national defence purposes and not for the arms trade would come as the result of "military spin-off" from civilian research.

The attempt to shif the responsibility to the scientists is a part of the campaign waged against science in all capitalist countries. In this connection one can often hear or read that if scientists were to stop working on the development of new weapons no new weapons would be developed.

In the capitalist social order the scientist has no de facto responsibility for the application of scientific discoveries, since the decisions are made without his being asked for his opinion. However, he cannot escape a certain moral responsibility, which is true primarily of scientists who work in the field of military research, for they know better than anyone else how the technical and scientific discoveries made in this field can be applied, and this moral responsibility plays a role in the struggle for disarmament. As citizens they must assume a consistent position in the corresponding movements such as the peace movement, in trade union organizations, etc.

The tasks of the scientist consist in

a) informing the other working people about the destructive possibilities arising out of a military application of technology and research, i. e. about the dangers unknown to the working people in other countries (as the CGT has done especially on the question of the nuclear weapon tests in the Pacific);
b) emphasising the requirements of research by pointing out the social requirements, especially under capitalism;
c) proving, with the aid of the trade union means of expression and action, that the potential in personnel and material made available to military research could be effectively employed in important spheres neglected by capitalism

It would be only too easy to play scientists off against each other depending on whether they simply concern themselves with their special field of research or take an active part in politics.

The dismissal of Frédéric Joliot-Curie who, at the head of the atomic energy commission, used his authority and position for making public declarations in favour of peace, clearly shows how much the capitalist state fears the direct engagement of the researcher as a conscious citizen. Because Joliot wanted to do justice to his double responsibiliy as a citizen and as a scientist, he became dangerous and so troublesome for the government that he was removed. The government could act in this way because at that time, characterized by the cold war and a widening of the split in the trade union movement, the labour movement weakened by this split could not struggle jointly aggainst this decision. Thus, this split created a relation of forces which enabled the government to act in this way. This example is a bitter, but clear illustration for decision and responsibility.

Joliot decided to act on his responsibility as a scientist and a citizen and was punished for it. This example can have two evidently contradictory effects, which lead, however, to the same result.

The first effect might be the scientist no longer participating in the struggle if he only wants to accept his professional responsibility.

The second effect could be the scientist giving up his profession if he decides to live up to his political responsibility.

In both cases the effects lead to an isolation of the scientist.

The first case amounts to a renunciation of opposition, an acceptance of the moral and political status quo in order to be able to pursue scientific research. At the limit–it is not exactly a limit, for it has been reached by a number of scientists–the researcher is made actively to support government policy.

Should we not rather endeavour to win him over for the cause of peace and disarmament? All of uns will agree that the only answer can be: "Yes, of course, we must win him over!" But in reality the question must be: "How do we win him over?" Does this winning over mean that he should decide between practising or giving up his profession?

If we formulate the question in this way, we shall certainly run the risk of winning over only those who have the constitution of a hero. And this would mean that we would be able to win over only a small minority of scientists after several years.

Research is in fact increasingly connected with production, with economic and social problems, and the choice resulting from this connection presupposes to an ever increasing degree that the specialist shows his colours; that he declares his opinion, i.e. that he should comply with his responsibility as a citizen and scientist. Only a Utopian could deny this reality.

How can a scientist live up to this responsibility without being blacklisted? We are of the opinion that the solution lies in the scientist participating in the common struggle allied with the working class, taking into account the specific conditions and organizations prevailing in the countries in question...

We believe that the individual scientist, or even the scientific community as a whole, has a relatively modest influence on the state leadership, which would not suffice alone to induce this leadership definitively to renounce their policy. However, united with all other active people in a common struggle, scientists have a much better chance of multiplying their forces to an unprecedent level.

The development of scientific research leads more and more to the creation of research teams. Consequently, the struggle and the scientists' contribution finds its expression through the collective organization of the struggle in which the scientific community as a whole is, thanks to the information it can give, a sort of catalysing element capable of creating a balance of forces which makes continuation of the arms no longer possible.

Far from alienating or reducing the independence of the scientist this collective struggle must make it possible for him to express his social and professional dmends fully and freely and also to assume all of his responsibilities.

A Note

N. Singh, India

Without minimising the dangers of atomic weapons, as the weapons of mass destruction with known and unknown terrible consequences for the present and future generations. main emphasis in the following is on the Biological and Chemical Weapons.

Dangers

Beside napalm and other incendiaries used for direct destruction of life and property, various anti-crop and herbicidal agents and defoliants have been used by the American aggressors in the countryside of Vietnam, justifying their use in the name of tactical weapons to pacify the conscience of mercenaries (soldiers and scientists) and the public at large. Use of these BC weapons in Vietnam has caused vast destruction of food crops, has given rise to still-births and births of malformed children as a consequence of teratogenic effects, and has led to incidence of endemic diseases, such as plague etc., by ecological disturbance.

BC weapons form the potential armoury of the foreign aggressors and of the unpopular regimes supported by the foreign reactionary powers, for use against patriotic forces and against guerillas and popular insurgents in the revolutionary struggles here and there, and more particularly in the agriculture-based societies in Asia, Africa and Latin America. Vietnam has been the testing ground and a philosophy of 'limited wars' has gained ground among the forces of reaction and aggression, based on the simple principle of 'feasibility' of the use of weapons in all efforts to defeat the 'total' enemy comprising the combatants plus the common people supporting them.

BC weapons are most effective in agricultural societies, most of which are semi-feudal and semi-colonial and, therefore, fermenting with revolutionary struggles. These very societies constitute the Third World, in which the present agricultural research & development is largely under the guidance of foreign experts with the latter having access to all intelligence concerned with ecological considerations of vital importance for effective use of ABC weapons. In its CBW programme, the United States have given priority to intelligence on agriculture in enemy countries, not economic but ecological in nature, and supported research and development with that information in view (see Marc Lappé in: The Social Responsibility of the Scientist, ed. by M. Brown, Macmillan

Ltd. 1970, pp. 96–118). The implications of the research, development and extension programmes of agriculture in the third world countries under the guidance of foreign experts and under assistants from foreign vested interests, in a state of 'limited' or 'counter-insurgency' war or even otherwise, are obviously against the interest of the revolutionary movements in these areas.

In case of movements against BC weapons, public complaisance, apathy and lack of concern is less easy to overcome, public conscience less easy to prick, and public opinion and pressure less easy to be roused and built up, more so when all public mass media are directly or indirectly in the hands of vested interests, because of the following situation:

a) BC weapons can not be shown in immediate and killing effects as directly anti-human to rouse the public conscience and opinion against them, since they are essentially aimed at systemate destruction of populations indirectly through starvation, diseases and teratogenic effects;

b) It is easy to numb the public opinion by creating confusion with respect to the effects of BC weapons, since the backward agricultural societies have been constantly published and portrayed as those suffering from recurring famines, epidemics and other natural disasters, and adverse living conditions;

c) The seeds for discrimation, based on colour/race/religion/ideology/region relations, have not so far been destroyed. Instead, the continue to be nurtured by mass publicity through TV and other media in the form of regular drone and hysteria, as particularly obvious against communism and for the superiority of advanced people from the industrialised societies and inferiority of the backward populations of Asia, Africa and Latin America. These are real dangerous situations, evident in open expressions or hidden in inadvertent reactions...

d) The attitudes of the great majority of scientists, beyond that as being part of the general public as above, continue to be irresponsible and dangerous either by non-committal unconcern with direct or indirect implications of their activities, or by active efforts in creating confusion and subverting public opinion from their mandarin status of being 'expert and specialist' in the present world. This they do by issuing judgements in the name of scientific 'objectivity', 'impartiality', 'lack of evidence', etc., and also in the name of 'national defence'...

Scientists' responsibilities

First and foremost must be clearly recognised that no movements of scientists alone, and led by scientists alone, can be built up for any successful struggles, including those against development and use of ABC weapons. Mobilisation and involvement of the common people is essential for increasing the public concern and pressure on the governments and ruling forces everywhere, and scientists must become a part, an intimate part of the growing struggles. However, the scientists have a special role in increasing the public awareness to the dangers, because of their present specialised knowledge and training...

For the scientists in the industrialised countries, it should be a major problem to determine their role and there is no intention here to sermonise to them. Only one thing may be mentioned that they may have to look anew at their socio-economic & political structures which breed the situations erupting in the present world, and then start thinking of the solutions.

However, scientists in the third world countries have very special responsibilities in this direction as well, as part of the people's struggles for rapid economic, social and cultural development. They must engage in research on protective measures against harmful effects of chemical and biological weapons, since their dangers can not be ignored. They have also to actively engage in research and production programmes for self-reliance in diverse fields and fight for adoption and implementation of such policies and programmes. Of vital importance is, of course, their active and conscious participation in the political struggles of the common people for liberation from the clutches of semi-feudal and semi-colonial forces, subserving the foreign vested interests.

The Necessity of Preventing the Development, Production and Accumulation of Means of Mass Destruction

K. Šiška, Czechoslovakia

The danger of chemical and biological weapons increases as science advances. In modern microbiology, genetics and molecular biology a number of results have been obtained which can drastically change the potentialities and significance of biological weapons.

The work on biological weapons is fraught with the danger that diseases may escape from the laboratory and cause epidemics the control of which will be most difficult, or even impossible... The continuation of work in this field, taking into account modern scientific achievements, can bring about such weapons of mass murder that the results will be much worse than the consequences of medieval epidemics, when up to half of the population of some countries died. This is why the prohibition of development, production and stockpiling of chemical and bacteriological (biological) weapons is so urgent.

As regards nuclear weapons there been incessant efforts of researchers, especially those organized in the Pugwash movement, to do away with them and to put a stop to armament with such weapons of mass destruction. At every Pugwash Conference this problem has been approached and discussed and let me, a physician, raise my voice in protest against them, too. No effort is ever spared on the part of physicians, aided by numbers of orderlies and nurses, to save the life of one citizen! We know very well the effects of the atom bomb dropped on Hiroshima. In 1970 I had the opportunity–as participant of the Pugwash confernce in Fontana near Chicago–to watch a film about the atom bomb. It consisted of two parts–the first part had been filmed in the years 1944–45, when the weapon then still unknown was only being produced, the second part at a time when its effects were known to everybody. The film made it quite clear with whose consent the bomb was dropped: It was not the scientists who gave their consent–they were shocked, broken and protesting vehemently against the abuse of the results of their research.

And that is why we must not cease to fight against the use of nuclear weapons. The agreement arrived at during the Pugwash Conference that the nuclear experiments be made underground is only a partial success, similarly as an agreement regarding the protection of the Ocean ground. In spite of these minor successes we believe that it is absolutely necessary for the atomic powers to convene a conference and to put a decisive stop to experiments in the atmosphere. It is in the interest not only of all of us, but of the future generations as well.

Everybody must raise their voices in protest not only against the use of nuclear weapons but also against experimenting with them!

Scientists cannot but come to the conclusion that, during the last years, the danger, potential harm and significance of bacterioloical, chemical as well as nuclear weapons have grown considerably. But at the same time, there arose a decisive struggle of broad masses against all these means of mass destruction. This raises the hope that the microbiology of death will lose in the competition with the microbiology of life, bringing the benefits of the latter to all mankind, and that, under the pressure of the world opinion, the former will cease to exist.

Knowledge and Responsibility

M. Steenbeck, GDR

The idea of convening this Conference was formulated at the 9th General Assembly of the World Federation of Scientific Workers, at a time when an effective international debate on disarmament of the states still seemed a very distant goal. Meanwhile the knowledge of the dangers of modern weapons and the necessity for disarmament have become greater due to the fact that world peace is gravely endangered in the Middle and Far East and in other places as well. The example of the Non-Proliferation Treaty shows how important the sciences and scientists have become for evaluating the possibilities there are for a peaceful future. This importance exceeds by far any declarations, however honestly meant; it acquires its specific value through the use of an objective knowledge to achieve clearly recognized political aims. The great dangers have not yet been averted. The aim of our Conference is to show how necessary it is to reach those aims the possibilities of doing this and the impact which the scientist can have...

There are real possibilities for mutual annihilation, but also for disarmament. It is the task of the scientist to conclude from the objective knowledge of those possibilities that he has to propagate them and demand the support of that part of humanity which wants to survive, and this is the majority. So it is not just a mere declaration for the sake of peace (something which goes without saying) that this conference wants to make. It rather wants to set forth objective knowledge as the only reliable basis for correct action.

It has mainly been since Hiroshima that a great deal has been said about the natural scientist's responsibility for the consequences of his work, since the power inherent in knowledge and the responsibility associated with knowledge which having been once acquired is maintained and remains applicable for good or evil at any time, became clearer than ever before... When we say responsibility, we mean the personal responsibility of the individual scientist. The fact that today the scholar has to face such a responsibilitiy arising from the social consequences of his work, is undisputed even by the natural scientists themselves. I do not wish to add anything to this taking the willingness to do so for granted. But as to *how* a scholar can live up to this responsibility or at least try earnestly to do so is often far less obvious if it goes beyond the matter-of-fact truthfulness of his special subject. It is mainly about this aspect that I want to speak today. For I feel that in addition to the many and different things to be said about this subject, a natural scientist who, like many of his colleagues, has been confronted with these questions during his life should also voice his views. I know that this will add a subjective element to his views, and I want to emphasize it here and now so that I need not repeat it again and again.

I am going to speak about the responsibility in three spheres of scientific activities which—as a matter of fact—overlap, but the objectives of which can be quite clearly distinguished: the exploration of still unknown ground with the sole aim of gaining knowledge; the practical application of a least fundamentally known facts, and ultimately the social, i.e. the political, economic, and cultural consequences which give scientific work its actual raison d'ètre. The importance of these three fields increases in this sequence.

The increase in our knowledge about the world in which we live which helps us to explore new ground is a necessity if we want to safeguard the existence of mankind which is increasing in numbers and its demands on life growing, and to consolidate and enlarge our world outlook. An increase in knowledge as such is never a social crime and this is where we know no taboos. It is only the application of knowledge that results in moral categories. And yet the scholar while seeking knowledge purely for its own sake is not free from social responsibility which, to my mind, does not include the demand often raised by outsiders that a scholar should keep to himself a discovery which he thinks might be detrimental to mankind. This is an unrealistic way of reasoning, and I want to state several reasons to prove it.

Generally speaking, there is no knowledge which can be used only to the benefit or only to the detriment of mankind. Therefore, a scholar would be overtaxed if he were to predict what other people might possibly do later on with the knowledge discovered by him and incomplete at first. This would imply that we—as the "other people"—were shirking our own responsibility by shifting the responsibility on to the discoverer. Besides, the demand that scientists should keep to themselves even possibly dangerous discoveries, is based on an overestimation of the individual scholar. This statement is by no means intended to disparage the achievements of great scholars, but the fact remains that every important discovery would soon have been made at some other place thanks to the large material and intellectual research capacities available throughout the world. And finally this viewpoint is wrong in that it takes for granted that all newly gained knowledge is at least the sole intellectual property of a discoverer who could use it at his own discretion. Even if the discoverer assumed the moral right to disregard the legal obligations which are almost always associated with his position, it cannot be denied that nowadays it is only in very rare cases that a new discovery is the result of the work performed by just one person. The assumption that all those involved in research work and also the many potential discoverers all over the world were and continued to be agreed upon keeping to themselves important though dangerous discoveries is just as Utopian as the closely related wishful thinking of conferring the power to rule the world on a board of prudent men. The hope for some omniscient, generally accepted and omnipotent authority in our human world only obscures the rigorous demands made on our thinking and action. By keeping knowledge to oneself one just tries to avoid personal conflict situations preventing this knowledge from yielding any results, and this would be without any ethical value. Silence, just like any other omission, is rarely a moral achievement. Of course, we should not remain inactive in the face of dangers inherent in new discoveries; but what we could effectively do will be dealt with only in connection with the social effects of scientific work ...

The researcher has a special responsibility in correctly selecting those problems of cognition which should actually be tackled. As a matter of fact this can hardly ever be done independently by an individual nowadays, who can, however, effectively influence the judgment and the decision to be taken. The standpoint that "something useful will at some time be somehow derived from all new knowledge" hovers in convenient unrelatedness above the real world. Not all new knowledge is of the same value at least for the present. To deny this would actually mean to follow a blind belief in progress, as the "other culture" accuses us of doing. It cannot be denied that even in the search for knowledge there is something like a fashion, a preference which cannot be fully explained in essentials for certain subjects and ideas which due to it might even have become especially "appealing" and thus are relatively easily financed. What are the problems of investigation the tackling of which can be justified from the point of view of genuine cognitive value, even if financial means intended social tasks are cut down? This is, undoubtedly, not only up to the scholars to decide, but it concerns them too. But in order to come to a decision the must know something about the prevailing social conditions. There is no generally accepted prescription or programme for this, and it is precisely this which is a characteristic feature of genuine responsibility; otherwise a computer could do it.

This applies even more when in exploring unknown ground the positive result gained thereby determines in advance the possibilities of its use, even if this has absolutely nothing to do with the original question of seeking nothing but knowledge. To make this clear I should like to give you an example which fortunately enough is a fictitous one. Should there ever be the slightest possibility of accumulating weighable quantities of anti-matter this might appear desirable for experimentally testing, say, its gravitational effect. But at the same time the explosive with the greatest possible effect would thus be developed. Would it be desirable to begin something of this sort? Since, as I told you, this is only a fiction we need not discuss the possibilities of preventing it.

Reality, however, does present questions of a comparable impact. In biology and in human medicine great findings have been made which are already applicable to some extent, and it is expected that even more profound knowledge will be gained e.g. in the field of genetics the access to which is through molecular biology; of organ transplantations; of influencing the brain by means of pharmaceutical agents or electric stimuli. This will enable us to deepen our knowledge about many vital processes and to use it in a way which until very recently was unimaginable. But the abuse of this knowledge which today is also seen or imagined to be possible would be a social explosive force not inferior to Hiroshima and its consequences if, for once, I may compare two incommensurable things. This is surely no reason to discontinue the search for knowledge in this field, it means, however, that steps to prevent such an abuse should be taken earlier and more thoroughly than was the case before Hiroshima. And this definitely belongs to the sphere of responsibility of those searching for knowledge in this field, even if they themselves do not aspire to use it as yet. I shall come back to this point later on.

The second sphere of responsibility of the scientist, namely the purposeful application of knowledge which is essentially already well-known, is much more important than the mere search for knowledge as far as its actual effects are concerned. Nevertheless I can deal with it in passing because here responsibility is much more immediate and obvious though this does not mean that it is easier to meet.

Anyone aware of such a responsibility participating in some important research work aiming at a certain target, say the development of means of rationalization with their effects on the labour market, or of new weapons with all their consequences and not only the military ones, must accept this target with all its implications. In order to do so he must be able to judge it, or must at least endeavour to acquire this ability to judge. This requires more than just special technical knowledge. In view of the constantly growing entanglement of all spheres of human work it would, of course, be absurd to demand from the scientist that he assess future effects of his field of work just as well as his special subject. But only the person who looks beyond the limits of his immediate work can assume responsibility, and if he notices something which is in sharp contradiction to his own concepts and values he should look into it further... Those who want to see only the "how" or the "what", but never the "why" of their work, are acting irresponsibly.

This takes us right to the third sphere of responsibility of the natural scientist which I want to speak about: the social effects of his work. To bear responsibility for some kind of event always means not to let it go unguided; in other words, it implies knowing what might happen in the future and having certain standards without which all arguments about responsibility would just be idle talk. These ideas and standards must not be in contradiction to rational thinking, else they will become utopian; nor can they be derived from a computer's thinking... Man's feeling is always imbued with imponderables which are difficult to comprehend rationally, i.e. a painting means more to him than an accumulation of dashes of paint and love more than a hormone effect. The concrete immediate and future objectives of the different forms and orders of the human society are extentially determined by the way of looking upon what we would like to see done and what it is necessary to do when picturing the future, particularly as regards the relationship between individual and society. Of course, we never know exactly what the future holds for us. It is easier for us to think of what might be in future, in order to single out according to our standards what should be. Here a blind belief in progress which only concentrates on desirable things, is dangerous, but it would be even more dangerous and would mean we were shirking responsibility if we denied altogether any possibility of progress and chose to drift aimlessly into the future.

This pessimistic attitude is partly substantiated by arguments based on scientific findings such as the following: since biology says that there is no such thing as homotropic inheritance, man's hereditary factors remain unchanged, including e.g. his innate aggressiveness, which is a basic obstacle to peaceful co-existence. But according to the results obtained from investigations into animal behaviour aggressiveness is almost always an anxiety reaction, i.e. it is only induced by actual or imaginary environmental dangers. Undoubtedly, these results can partly be applied to man as well. His environment is his society; if it is properly arranged it can relieve the individual from having to live in constant fear which often had quite real reasons. The war of aggression, however, is nothing but an invention by man and by no means a mere anxiety reaction although—camouflaged as a preventive war—this is what it is often called in order to justify it. But it, too, is exclusively society-linked. As a matter of fact, homo sapiens does not continue to develop biologically, i.e. as an individual, but socially within his social structure; and it is here that acquired properties and experience are indeed transmitted to the next generation through education and the passing-on of knowledge and values. However, these things should be taken serious. In view of the great prestige enjoyed by the natural sciences we have a special responsibility in recognizing the priority of social development.

While thinking about what might be in the future many scientists have a propensity for optimism which, without a corresponding form of social development, is irresponsible in its nature, just because they see more clearly than anybody else the possibilities there are for development in the field of science and technology. We tend to underestimate the possible social dangers. Shortly after Hiroshima I still believed, for instance, that to prevent a disaster of this nature from being repeated it would be sufficient if the Soviet Union, too, had 5 or 10 bombs of this type for a possible counter-strike. In the light of present reality this sounds like an idyllic child's belief. Therefore, I no longer dare to say, as much as I would like to, that other thinkable dangers ensuing from a possible abuse of scientific findings are only the horribly sadistic phantoms of an imagination run wild. If the present-day knowledge of organ transplantations had been available at the time of the Auschwitz concentration camp it would have been no problem whatsoever—to put it in the brutal jargon of this way of thinking—to slaughter at any given moment one of the inmates, whose life was not worth a penny anyway, in order to provide a donor of a fresh heart whose endogenous protein matched as near as possible that of the recipient, just to save the life of some important person. Is it really out of the question that something like this will ever happen in the future, for there is still racism in the world of today, and whole peoples are still looked down upon as subhumans. Or to give you another example: it has become possible to implant a fertilized human egg in the uterus of a host mother. To give birth to a child which is not her own can be a great moral achievement for a woman; but she could just as well be degraded to becoming an incubator. And, finally, calculations made to find out which type of robot would be the cheapest to use in the future came up with the following answer: insert appropriate electrodes into the soft skull of a baby, feed it until it is fifteen years old and then control its brain by electronic stimuli to make it do "robot" work, for no electronic computer is as cheap as the neutron structure of the human brain. If you consider this to be unthinkable remember that Auschwitz was once just as unthinkable. Such an abuse of highly valuable scientific achievements can only be avoided through higher social development. And it is the natural scientist who may not stand idly by. He has to explore what might happen as objectively as possible and then with inner conviction help make sure that the necessary measures are taken. This requires taking sides politically. I myself took sides, although I shall not go into details here about my personal decision. For the most dangerous enemy is not some other kind of conviction, but indifference.

There are many possible dangers emanating from new knowledge. Man must never again be in the position of having to face up to these new findings lacking in advice and knowledge as was the case with nuclear forces. If experts do not adopt a responsible stand in this matter, charlatans devoid of any sense of responsibility will do it for them.

The Rôle of Scientists in Maintaining a Climate of Understanding and Cooperation among Peoples – a Significant Prerequisite for Disarmament

L. Takacs, N. Teodorescu, Roumania

Due to the arms race immense sums are being spent daily for unproductive purposes, and millions of people are kept from socially useful work. Apart from the actual arms expenditure which burdens the budgets of all countries and nowadays amounts to more than 200,000 million dollars per year, the arms race prejudices worldwide commercial relations and prevents the most important social problems from being solved in the interest of individual peoples and for the benefit of mankind as a whole. The problems of the immense explosion in the world's population, of overcoming the adverse effects which technological and industrial development have on the life of people in cities as well as of overcoming underdevelopment and many other problems which can only be solved through the joint efforts of all peoples, stagnate, remain mere plans inspired by noble humanity for the simple reason that the necessary financial means are swallowed up by the arms race...

Furthermore, we must not overlook the fact that the monopolies are making fabulous profits from the arms industry and are not interested in lessening fear, distrust and rivalry between the countries. Due to the direct influence which these monopolies exercise on the ruling circles in some countries, production and trade in the field of armaments are the main driving forces behind the arms race. In a climate of general insecurity many states are forced to increase their military strength in order to protect themselves against any possible acts of aggression. Even the underdeveloped countries which are striving against great odds to improve their economic and cultural development were compelled in 1969 alone to spend – more or less in the form of tribute to the war monopolies – a total of 1.5 thousand million dollars on armaments (SIPRI Yearbook, 1969/70, p. 491).

The present state of international relations which is characterized by the stockpiling of an immense destruction potential, together with the danger of even accidentally unleashing a world war with unpredictable consequences for all mankind, makes it clear to everyone that all available resources must be mobilized and campaigns organized to avert this danger.

One of the most tragic contradictions of modern society lies in the fact that the most significant discoveries of science which provide man with new possibilities for mastering the uncontrolled forces of nature and for utilizing them for the benefit of all, may, at the same time, counteract progress. Under the present structure of the international community in which, unfortunateley, features of imperialist policy still prevail–first and foremost US imperialism, the policy of strength, aggression, hegemony, interference in the affairs of other countries etc.–the general development is marked by the fact that each new discovery, for instance, nuclear fission and fusion, any advance in chemistry, biology, radiology, electronics and communications, in laser techniques, in conquering outer space and the ocean depths have been used and are still being used to produce and improve means of destruction.

The utilization of scientific and technological achievements for purposes that do not serve progress deprives the sector of work for peaceful purposes of valuable scientific potential, i.e. of scientists, research workers, qualified engineers and technicians–many highly specialized workers who are so urgently needed in all countries and in the developing countries in particular. The number of people employed in the arms industry is estimated to be 50 million, i.e. 4 per cent of the total number of people engaged in productive work...

The clear awareness of responsibility for the fate of all mankind or–on a more limited scale–for the fate of one's people, family or even one's own person ought to disturb the peace of mind of those who passionately devote themselves to research, who strive to open wide the floodgates of truth and to explore the unknown, no matter how frightening and hideous this unknown may seem to their terrified eyes.

Today the question of conscience is more complex than in the past. Under the present conditions, when mankind is well on the way to eliminating certain hot-beds of war that threaten to develop into a world-wide conflagration, when in international relations the forces of aggression and the forces opposing them can be clearly distinguished by all people of good faith, then any "neutralism" on the part of scientists is inadmissible.

Scientists who are engaged in exploring new laws of nature, in explaining social phenomena and society's development trends are able to predict in a relatively clear manner whether the results of their activities might be used for anti-social purposes. This ability to predict should provoke each scientist to join in with those social forces representing general progress, which are organizing themselves more and more closely and influencing the course of international events to an ever increasing extent.

A passive attitude, research for the sake of research, passionate devotion to one's special field of science without consideration of the problems in the surrounding world, is no longer compatible with the task of a scientist.

The scientist must be a fighter in the service of his people, indeed, of the whole of mankind. He must give his full support to utilizing the scientific and technological revolution, which has radically changed the man-machine relationship and provided human society with stupendous means for harnessing the most powerful forces of nature for peaceful purposes, for guaranteeing everyone a life without the spectre of hunger, disease and satanic destruction.

If scientists would take pains to explain to the masses what armament really implies, the great dangers inherent in discoveries and inventions aiming at destruction, if they would examine their own conscience and stand up for the renunciation of all research work detrimental to mankind, then this would be to the advantage of science itself, since the immense sums consumed in designing means of destruction could be channelled to research work for equally spectacular but useful purposes all over the world...

A main objective of all progressive forces in the world is disarmament. Cessation of the arms race, a cut-back in arms expenditure, liquidation of the tremendous destruction potential and thus elimination of the fear and danger of destruction hanging over our civilization–these are demands of today, these are prerequisites for progress.

It is generally known that the attempts at achieving agreement on arms limitation and arms reduction were initiated some decades ago. Although every step in this direction was doomed to failure in the League of Nations due to the structural shortcomings inherent in this international organization, the Organization of the United Nations, on the other hand, constitutes a legal framework within which this objective is possible to achieve. In accordance with the UN Charter the Security Council is bound to submit proposals for establishing a system for the regulation of armaments (Article 26), and commissions were set up but their activities, however, were not reflected in effective measures.

The creation of a new 18-Nation Disarmament Committee (five socialist, five capitalist and eight non-aligned countries) in 1961 permitted more organized discussions on problems of disarmament, the elaboration and the comparison of different proposals aiming at concrete measures. Although the Committee, which has been extended to 26 member states, failed to reach agreement on the most important disarmament problems, the climate created in the course of its activities helped bring about the conclusion of multilateral treaties which induced a certain easing of tension in international relations. Proof that certain more reasonable conceptions have prevailed in international relations is provided by the treaties concluded between the USSR and the Federal Republic of Germany as well as between Poland and the Federal Republic and by the Quadripartite Agreement on West Berlin, all of which constitute new positive steps towards overcoming certain differences of opinions between the nations...

Mass campaigns for promoting progressive trends in international relations are a typical phenomenon of our time. A great number of national and international non-governmental organizations are already working in this sense by mobilizing the masses in oder to prevail upon their governments to pursue a foreign policy of peace and cooperation, in order to put and end to acts of aggression and to liquidate the hot-beds of war existing in the world. The World Federation of Scientific Workers has a major rôle to play in these growing efforts. Its objective, i.e. the promotion of cooperation between scientists from all over the world with a view to developing science for the benefit of mankind an for a peaceful world, is one of the noblest aspirations of the peoples. We hold the view that this disarmament conference summoned by the World Federation of Scientific Workers is a positive step towards realizing this ardent desire of mankind.

Like other peoples we are struggling to ensure that general declarations on disarmament are quickly followed up by practical solutions that will reduce and eliminate the danger of war, put an end to the arms race, and make other practical disarmament measures possible... In order to further these aims, we think it expedient to convene a world conference of all states on the problems of general disarmament and of nuclear disarmament in particular. Until general disarmament can be brought about, we should encourage all those measures aimed at limiting and reducing armaments, at putting a stop to any further developments in ABC weapons, and at creating nuclear-weapon-free zones in various regions of the world. At the same time we must also support other measures aimed at achieving the ultimate objective.

Scientists of Roumania act in full accordance with the spirit of the demands mentioned above. In the framework of our Federation and of other social organizations as well as in scientific, cultural and educational institutions they participate in socio-political work in which international problems as well as the promotion of the ideals of peace and friendship among peoples play a major role. Now as before we attach great importance to developing even closer relations of cooperation with scientists in other countries. Roumania has often been host country for a great many sessions of international scientific organizations and for scientists from all over the world... Whenever Roumanian scientists participate in international conferences and appear in public or visit cultural and scientific institutions abroad, they never show indifference or neutrality with regard to political problems that concern the whole of world public opinion.

We hold the view that—in accordance with this militant attitude—all scientists, together with the World Federation of Scientific Workers, should fight for and advocate:

- propagation of the idea among the masses that the arms race is a great threat to the whole of mankind, especially in the field of nuclear, chemical and biological weapons;
- a contribution to forming mass opinion and to concerted effective support of mass campaigns demanding concrete measures with regard to disarmament and eliminating the danger of a nuclear war;
- development of a climate of understanding among nations by means of manifold cooperation at various levels, direct contact between scientists and representatives from different spheres, support for open and frank discussions on certain issues, and patience and mutual understanding when striving for suitable solutions.

We hold the view that scientists must strive for the immediate convocation of a World Conference on Disarmament in which all nations are free to participate.

Possible Activities of Scientists in Their Own Sphere of Work; Influence on Research, Education and Training

K.-H. Wirzberger, GDR

Anyone who teaches and educates others, who exerts an influence, must be certain that he is doing the right thing. Being able to make use of a reliable criterion in deciding what is right and what is wrong, what is good and what is evil, is important for the consequences. It is evident that tradition, belief, discretion or inspiration are not the right criteria here. To learn that decisions on the social consequences of scientific activity can not be made irrationally but on the basis of science is of great educational significance. To impart knowledge and ability without at the same time teaching with what aim in mind the knowledge is applied and that responsibility accompanies its application is to remain in the realm of patchwork. We believe that an important part of education and training is for the student, the young scientist, to have experienced and tested how the questions of conscience can be answered on the basis of science without slipping into irrationalism. If our coming generations of scientists do not experience this, if the training ends only with the acquisition of knowledge without teaching something about its application, then we would at best graduate from our universities "inventive dwarfs" (to borrow a phrase from Bertolt Brecht).

We–and I am speaking here for those who share the scientific world outlook of the working class–believe that precisely this world outlook is not only the foundation for all other sciences but also the basis on which the questions as regards deciding between right and wrong can be answered. That is why it is of such great fundamental importance for us. That is why it is the foundation of all the scientific and educational work in our universities and colleges.

Asked at a conference like this what makes us so certain that this foundation will always stand the test, I can only answer as follows. Even if Marxism-Leninism, our scientific world outlook founded on dialectical and historical materialism, were to have done no more than unveil the secret of how wars are caused, and thus show how they can be prevented, and even if this outlook were to have done nothing more than show that an order based on exploitation is not unchangeable, is not an unshakable law of nature, then this alone would have proved its usefulness, its superiority.

Such an outlook also decisively helps to deal with the problem of the so-called "blinkered specialists" mentioned by Herr von Weizsäcker, who know everything there is to know about their special branch of science but nothing about society. This is possible because to our way of thinking the objectives of society and those of science are not opposed to each other. It is clear to our students that because of such agreement on fundamentals the scientist does not find himself faced with the question of averting or preventing evil. In addition, our entire educational conception is founded upon the endeavour to bring about the unity of technical factual training and the civic socialist development of personality...

The conviction that we are educating in the right spirit and employing science for the correct aims is nourished by complete accord between the sense of our work and the sense of socialism, namely: "to do everything for the welfare of man, for the happiness of the people, in the interests of the working class and all working people". This conviction is not based on a belief or a hope. It results from knowledge! It is justified by the historical achievements of the working class struggling to liberate makind, it can be verified and is proved by social, historical experience...

A scientifically educated and trained person can only reach his full social effectiveness if he knows how to classify the different phenomena in social development and can see his own role clearly even though the situations in which he has to make a decision are complicated and he may suffer reverses. In order to make decisions which are scientifically unshakeable and at the same time both correct and humane, one must have learned not to see the world as it appears on the surface or as one would like to see it. One must always see the world as it *really* is, i.e. as the battleground of complicated class struggles. By doing this—and we believe *only* by doing this—is one in a position to overcome the dilemma of which evidently many attending this conference are well aware when speaking about their own predicament and possibilities. From this we, therefore, derive, among other things, our own unshakeable conviction that a sound Marxist education is the most general and at the same time most important basis for every type of scientific work and for every decision to do with the way in which the results are applied. The scientist, whose importance should not be misused, must know what is what in the world. This means that he must also have a deep knowledge of the different classes and their interests. He must find a scientifically based answer to the thousand-year-old question "cui bono?", and he must be able to explain his answer to his students without turning red with shame...

I would like to say a few words about why I consider it so important for the scientists to go before the public and express their views on the decisive questions of the time. The postulate of Karl Marx, that the working classes would have to penetrate the secrets of international politics and take a look over the shoulders of their governments, has been put into practice since the October Revolution. Where the working class is in power the welfare of the masses determines policy. But even where this is not yet the case no policy can be enforced against the will of the masses. Worldwide attempts to work against the interest of the masses are met at the same time by increasingly powerful worldwide protests. It may suffice to mention just two examples: the movement to ban atomic weapons or the struggle to save the life of Angela Davis. The movement of the masses is the framework within which the scientist's appeal to the public really moves and changes something. To a scientist who shares my ideological standpoint and carries out his work as a scientist on behalf of the working class it is clear that his place is in the midst of the masses and that he should raise his voice together with them. We believe that the weight of the scientific personality is not determined by his being the solitary towering figure, the great individual who does the thinking for all the others. No, we rather believe that he can only reach full effectiveness as a personality if he is borne by the masses and works to serve their well-being and interests...

Thirdly and lastly I would like to make a few remarks to the effect that as a teacher, as an instructor, one must consider very carefully what is genuinely realistic in our present situation in Europe, what we can do, what we can carry through. For we then place these goals at the centre of our political work, which is always determined by both the general trend and the tasks set by the day. That is, by the tasks which were laid down in June 1969 by the Conference of Communist and Workers' Parties, and by the struggle for European security, concretely the struggle for the ratification of the treaties concluded by the Soviet Union and the Polish People's Republic with the FRG and for the convocation of a European conference on security and cooperation... It is part of the responsibility of the scientist to perceive and assess correctly this goal which has been fought for for so many years and which is now poised to bear fruit, and then devote himself fully to the struggle for its realisation. Seen from this angle it is right and proper for us to support the notion of a union of all social forces which are striving for this end, and to contribute to unified action in order to ensure a peaceful and democratic future for Europe.

Since all processes develop in a complicated way the academic teachers who have equipped themselves with a scientific insight into the dialectics of the international class struggle—and what is taking place now *is* class struggle—should also help their students to recognize friend from foe. In view of the changes in and attempts by imperialism to adapt itself and in view of the ultra-leftist groupings aimed at sowing confusion, this is an important task and places a great responsibility on us. The character of imperialism has not changed—this needs to be shown and proved; our common cause, the safeguarding of peace, will thus only be reached through determined action by all anti-imperialist forces. But it is also necessary to avoid getting into a blind alley, retreating, for example, from science because it is allegedly the source of all threatening developments—from the arms race to the pollution of the environment. If we were to follow this advice not only would there be no progress it would also mean that the forces which really threaten life on earth were given a free hand...

The Need to Fight for Disarmament

The Need to Fight for Disarmament

Resumé of the Conference by H. Budzislawski (GDR), Vice-President of the World Federation of Scientific Workers

When we began some time ago with the task of organizing the Conference which is now coming to an end, we were faced with the problem of deciding on the way we should carry out our discussions. Should the nuclear physicists, the biologists, the chemists and the social scientists discuss all the questions resulting from the development of the means of mass destruction in their own separate groups? We decided to do it another way. We subdivided the Conference into three parts: one part dealing with the dangers which have come about as a result of ABC weapons, one dealing with the real possibilities for disarmament and finally one dealing with what the scientists have to do. In this way it was possible for everyone to participate in everything and as a result of this we gained a kind of common picture.

As far as the ABC weapons are concerned, it becomes immediately obvious that they are subject to continual change and elaboration. It is almost impossible to keep up with the latest developments in the field of ABC weapons, certainly for the non-scientist, but also for the experts who only know what is going on in their own branch and have practically no idea of the other possibilities that exist. Thus our task was, and is, to deal with the ABC weapons as a whole in different lectures and thus to build up an overall picture.

What did the Conference tell us about the prospects for further scientific development and improvement of weapons? Science not only provides us here with basic knowledge (as, for example, it once provided us with the knowledge of nuclear fission) but also more and more with advice on design. Thus in many cases the scientist deserves more a military rank than a scientific one. Scientists helped to bring about a scientific and technological revolution in the military field.

Taking this as the objective state of affairs, then our next task was to take a look at the possiblilities that exist for disarmament. Disarmament is what we must aim for. We could, instead, of this, aim for a set of deterrents in order, ostensibly, to maintain peace. This is a contention which is widely spread through many circles. Deterrence, they say, amounts to nothing more than a balance of terror. But deterrence only replaces disarmament as a peace factor for a short time and deterrence possesses a certain dynamism–it grows with every day!

Between deterrence and disarmament lie possibilities for negotiations, on stopping armament, for example, or on partial disarmament. When talking about disarmament we cannot in the same breath speak about deterrents as something which secure peace just as well. It also had to be shown whether disarmament constitutes an economic catastrophe. The economists said it was just the opposite. A small excursus allowed us to glimpse the wealth which science and disarmament could bring. By renouncing deterrence and by concentrating on using science for useful purposes we can expect great wealth to be created.

The question had to be put as to how we arrive at disarmament. There is no doubt that disarmament is a task for international law. It has to be brought about through treaties, bilateral and multilateral treaties, through a security conference, through a treaty on security. The question had to be put as to whether partial disarmament measures are also a possibility or whether partial disarmament measures have a tendency after a certain period of time to lead to a regeneration in armament in other fields.

The question of control had to be put, a task which is evidently capable of being solved scientifically in certain fields. But are there only control measures of a technical kind, or are there also ones of a political nature, anchored in international law? We had to point to step-by-step disarmament, to a step-by-step stop in armament, to treaties already existing, as, for example, the Treaty on the Non-Proliferation of Nuclear Weapons etc. Further step-by-step disarmament is evidently something which is, technically speaking, immediately possible. One could create nuclear-weapons-free zones...

The third part which we planned was devoted to scientists' responsibility. Scientists can try to influence governments in favour of disarmament. They can make proposals for disarmament measures. They can explain why the deterrent theory is not something which secures peace once and for all. And they could make it clear to governments that all the material left over after disarmament could be exploited economically. This would be of great help to the governments.

A further task for scientists in their responsibility is extending the circle of scientists struggling for disarmament. Students, assistant lecturers and professors from all disciplines should develop understanding for disarmament. International organizations should concern themselves with measures for peace. We had to see whether the World Federation of Scientific Workers could create its own authority, its own body of an intermediary nature for this purpose.

The scientists' responsibility also covers the field of information. Scientists could say which disarmament solutions are practicable. In this way they could help rationalize the process of negotiations. They could sort out and add to the measures against the means of mass destruction. And they could disseminate their knowledge by means of the mass media.

When the scientist does this, then he comes to the conclusion on his own that he must unite with all the different war-opponents. We need alliances for the specific purpose of promoting disarmament. Scientists have authority, and one could use it to fight for peace and against war.

In trying to name several of the features characteristic for this Conference I would like to say that it has introduced clarity into things which before were confused and difficult to get a complete picture of. And I believe that it had a new quality, which consists of its revealing the unity in our will and knowledge despite our diversity.

Unity despite our diversity means that we are scientists from the most varied disciplines, natural scientists and social scientists, chemists, physicists, men of medicine, biologists, journalists and economists. We all have our own special research fields and areas. And this diversity grows larger with increasing specialization. And yet we all have one common concern, indeed, even one urgent necessity common to us all, the pursuit of which has brought us together. We of all nations, with the most varied knowledge, want to maintain and develop humanity further.

Very often we speak different languages, not only because we represent different nationalities but also because our specialized disciplines cut us off from one another, because in the field of our disciplines, which have developed such highly specialized areas of knowledge, a special language is nowadays used, so much so that the non-scientist hardly understands a word. Things have developed to such an extent that even the specialist in a related discipline often has difficulty in understanding his neighbour.

And yet in the three days that lie behind us we have not talked at cross-purposes we have talked to one another. And I think that during all the discussions and controversies we have understood one another. Our Conference has shown that we can speak a common language, the language of genuinely seeking for real ways of ridding the world of this terrible threat, which the pictures of yesterday evening once more brought before our eyes more vividly than the words of any language could do.

And we also have unity despite our diversity because we are gathered together here, we have come here from many parts of the world, from four continents, to discuss our cause, the cause that unites us all, the cause which we hold to be the most urgent and most important concern and for which we consider ourselves to be especially responsible, since we feel that our knowledge and our skilled know-how weigh heavy on the scales and can tip them to one side or the other, for good or for evil.

We want to devote all our energies to using our scientific toil and knowledge sensibly. We do not want our research activity, which could do so much for man's higher development, to be used any longer to threaten and be a perpetual torment for humanity.

We want to help humanity to rise up as far as our humble forces can contribute to this. And united together these forces are not humble, they are gigantic. Instead of pushing humanity in a helplessly disoriented state into the deep chasm, into the nuclear inferno or into chemical destruction, we could lead them to truly great heights.

As scientitsts who have sworn allegiance to life and who have declared war on war, we have reached a new stage in understanding. But we have not as yet come to the end, we still have a long way to go before we attain complete disarmament. I consider this Conference to be a very important step which can unite scientists' efforts in order to reach the high aims we have set ourselves. But on the other hand I do not believe for one moment that we all know to the same extent what disarmament actually entails or exactly what it is we are striving for when speaking of disarmament. We cannot give any recipes here on how to reach an objective that is continually changing. Our Conference was a working conference. It tried to shed light on the problems raised by the terrible ABC weapons, their operational use, and in particular their elimination in the different fields, the technical, chemical, biological, medical, economic fields and the field of international law. It has also made suggestions in a lively manner and tried to find solutions to the questions which have arisen. It has candidly disclosed fact which not many of us knew before or could fit into the overall mosaic. The progress which it represents consists not least of all of the fact that it not only generally declared the scientists' love of peace and that it not only illuminated the horror and the unforeseeable dangers presented by the use of ABC weapons. It has made it clear to us all that we are fighting for our lives.

Our Conference has shown that there are many new possibilities for striving to gain control over armament, arms limitation and step-by-step disarmament. But there is a danger of there being a relapse to arming anew if we lose sight of the objective, still unobtained, of general and complete disarmament.

During the past few years something new has arisen. Some people call it a new climate. Let us say clearly what it is: a new relationship of forces has arisen. If before ever-accelerating armament was considered the only way of securing peace, this imperialist view had to give way to the new opinion that peace is not secured by imperialist superiority but that, at best, only a balance of terror could protect us from the terror weapons ever being used. But it is becoming more and more clear that this so-called balance of terror does not really constitute security for the peoples and that it must be replaced by step-by-step and then by complete disarmament.

It is being recognised more and more that nowadays war is no longer a practicable instrument of politics. This has come to be so because the peoples throughout the whole world are better informed on the causes and methods of war. Our own World Federation of Scientific Workers has made a by no means unimportant contribution to this. Scientists are not without power if they organize themselves and take up the struggle against war. They are actually limiting more and more the room for movement of unscrupulous politicians who are trying to bring the world to the brink of destruction.

There now exists a real chance for a world disarmament conference and a conference for collective security covering large geographical areas to become reality. A World Disarmament Conference which we rigorously demand, can unite the constructive efforts of all states regardless of their social orders and make significant steps towards general and complete disarmament possible. A conference of the Five Nuclear Powers would do justice to the general concern for disarmament in the nuclear sphere. It would be an expression of the responsibility which these states carry for nuclear disarmament.

The connection between disarmament on the one hand and a relaxation of tension on the other has been dealt with by several speakers at our Conference. A European Security Conference would be especially valuable in promoting this process in Europe. Our Conference has confirmed us in our conviction that there should now be no hesitation in going over to making multilateral preparations for such a conference. What we demand is peace everywhere, in Vietnam, in the whole of Indochina and thus more favourable conditions for disarmament in Europe as well.

It fills me with gratification that the World Federation of Scientific Workers has chosen Berlin, capital of the German Democratic Republic, as the meeting place for its Conference. The citizens of our country, who follow this Conference's work with great attention, are of the opinion that their capital city is the proper setting for this Conference. The GDR has signed and ratified all existing treaties dealing with questions of arms limitation. And it has created all the inner-state conditions which allow them to become fully effective. Even the Constitution of the GDR firmly anchors the principle that the GDR will actively and constructively do all it can to further disarmament measures and to promote detente and security among the peoples. The host country thus finds itself in complete agreement with the aims of the World Federation and with the intentions of its Conference.

We noted that through frank discussion all the participants tried to show exactly where they stand. We too have laid down our standpoint in our great endeavour–which does not and cannot limit itself to scientists–to find allies for our common cause. We scientists as individuals, and even more so in an organized form, are perhaps capable of achieving a lot, but our fight against the means of mass destruction will only be a successful one if we seek out allies for ourselves, who, like us, are not only interested in banning and destroying certain types of weapons, but in banning all wars and in destroying all weapons. These allies exist: they are the popular masses and in particular the working class! Our scientific discoveries can only be transformed into social reality through the actions of the peoples.

Renunciation of weapons means, of course, renunciation of power. We, with our extremely different ideological positions, whether religiously-minded or not, who come from the bourgeoisie or from the working class, who are socialists, Communists or adherents to a capitalist type of economy or who are perhaps not even included in the above list–we are all agreed that elimination of the instruments of power is a necessity, an order of the hour, if human society is to continue to exist meaningfully. We have struggled here to define, to outline, the scientist's responsibility towards society. This social responsibility is not something which is apolitical. It is always something concrete and can never be separated from the social conditions under which the scientist works.

If I say that we have discussed with one another and have understood one another I do not wish to abscure the differences which exist between us. We do not agree on everything and this is something which cannot be expected. I for my part am inseparably committed to the socialist society in the German Democratic Republic.

However, the Conference has shown that we can discuss our basic problems, the questions of our existence, with one another. And thus it has also shown that the many-sided talks can also be continued and–as I believe–must be continued. We are all sitting together on top of the ABC volcano. This situation of ours is irreconcilable with a contemplative mode of behaviour. It forces us into action, i.e. to take up conscious political activity against those dangers and their causes which we have discussed at this Conference.

Concluding Speech

E. H. S. Burhop, President of the World Federation of Scientific Workers

The conference has reached its final stage and my duty now is to conclude it. As Professor Budzislawski said, although we are ending our deliberations here, the influence of the discussions must continue. The very important statements that have been made, both in the papers and the discussion, must not be lost. They must be used to help in the great campaign that needs to be launched for a new attempt towards disarmament. We have been discussing the responsibility of the scientist. About the degree of that responsibility there may be differences, but clearly one aspect of the special responsibility of the scientist is to play an indispensable rôle in informing public opinion about the consequences of the arms race and encountering the current cynicism and defeatism in some circles about the possibility of disarmament.Before we can make a credible demand on the World Disarmament Conference, it must first be convened as a result of the pressure of public opinion in many countries. The issues that are raised in relation to disarmament and to the abolition and control of weapons of mass destruction are very complex. The points of detail that I mentioned have been so interminable, the public has become bored or has come to think that it can never grasp the real implications of the issues involved.

We, I believe, have a special rôle in this context, and not sufficient thought has been given to the approach to the popularisation or the popular understanding of the issues raised by disarmament. One of the most important things we could do would really be to think about how we can present the discussions at this conference and the issues involved in disarmament to the general public. Because I feel absolutely sure that there can be no successful movement towards disarmament without a real consciousness on the part of the public in many countries, a public which may be really not very well trained to understand the issues involved. This is, I would feel, one of our important problems.

We are very anxious to cooperate with all like-minded people who wish to work towards disarmament and the control of nuclear weapons. We shall certainly go the whole road in this cooperation. We hear of many organisations taking up this question of disarmament again. We know the continuing activities of the Pugwash Movement, so many scientists from which we could heartily welcome here today, and we would very sincerely like to improve our contact with the Pugwash Movement. We understand the conditions under which the Pugwash Movement operates and that there is no direct cooperation with organised bodies. Nevertheless, I do feel that there are more ways of cooperation between the Federation and the Pugwash Movement, since we are struggling for common aims...

Professor Budzislawski has thanked many of the people who have been responsible for the organisation of the conference, but, of course, he could not thank the main figure, namely himself. And I would like to express on your behalf, I am sure, our appreciation of his initiative in suggesting this conference and of all his selfless efforts. And I would also like to add my thanks to the people whom he has already mentioned ...

I would like to say something about the excellent technical arrangements. You know that all this does not really exist. There is no such place as the German Democratic Republic. At least that is what my government says. I am speaking personally now and in that capacity I am a member of a Committee for the Recognition of the German Democratic Republic in Great Britain. I do wish that Sir Alec Douglas-Home instead of going to Rhodesia would come to Berlin and see that there is such an institution as the German Democratic Republic. I think the recognition of the GDR would be a very important step towards the consolidation of peace and security particularly in Europe.

Professor Budzislawski mentioned that it was very good that we were meeting in Berlin. I think also, not only in the sense in which he referred to it, but surely it is symbolic that we are having a meeting on disarmament and on peace precisely in Berlin, which for almost a century was thought of as a focus of war. I think that there is no need to underline this but I think all of you can see the changes that have come about in the situation in the last quarter of a century. Finally I would like to thank all the contributors to this conference. The arrangements could have been as excellent as possible technically, but without really high quality and thoughtful papers the conference would have been dull and achieved nothing.

I thank you all for coming from so many parts of the world to spend three or four days in Berlin for this purpose. I wish you all bon voyage back to your respective countries and I do hope that the message of this conference will be spread widely and will show itself in a new activity on behalf of disarmament, which I think most of us consider the most important problem facing humanity at this particular time. Thank you all very much for participation. I declare the conference closed.

Resumé of the Discussion

The Dangers presented by ABC Weapons

The starting point common to all discussions, supplementary papers, questions and comments as well as controversies was complete agreement both regarding the immeasurable dangers which ABC weapons constitute for mankind and also regarding the necessity and possibility of putting an end to the arms race and of reaching agreement on step-by-step disarmament together with a strict ban on the means of mass destruction.

At the centre of discussion were the manifold causes and driving forces behind the arms race. V. G. Trukhanowsky (USSR), making reference in particular to D. R. Inglis (USA) and E. v. Weizsäcker (FRG), declared that he could not help but think that the argument implying that the Soviet Union kept the number of its missiles and nuclear weapons secret, was used by the other side simply as a pretext for continuing the arms race and for obstructing genuine progress in the negotiations on arms limitation and disarmament. The contention that secrecy is to blame for the arms race is illogical for the very reason that it was D. R. Inglis himself who had supplied the conference with exact information on the magnitude of Soviet A weapons and missiles, he continued. In this connection he referred to the latest publication by SIPIRI in which there was a table of the USA's arms expenditure between 1959 and 1971, and also the military expenditures of NATO in the same period as well as those of the Soviet Union and the Warsaw Treaty states.[1] "... In conclusion I would like," V. G. Trukhanovsky said, "to ask and urge all those present to do the following: Do not let us start haggling over what might be hidden away in a dark corner somewhere in the Soviet Union or what might be hidden away somewhere in a dark corner of the USA. Let us rather orient our joint endeavours towards bringing about rapid agreement on doing away with all warheads and missiles."

Touching on the problems of shrouding armaments in secrecy, questions were discussed arising from the development of intercontinental ballistic missiles, of multiple independent re-entry vehicles,submarine–launched ballistic missiles and anti-ballistic missiles. Doubts were raised as to whether laying down a set level of arms or limiting them at a set number might lead to "controlled armament". (E. H. S. Burhop, B. T. Feld, D. R. Inglis) The discussion made it plain that a "balance of terror" and the system of deterrents did not constitute a secure fundament for peace. Referring to the arguments of B. T. Feld (USA) and others, that the rapid development of Soviet super-large SS-9 missiles constitutes a serious threat to successful continuation of the SALT talks, several of those participating at the conference expressed the view that it would not be the first time that unsubstantiated reports (which are often even fabricated by American secret service agents) regarding new Soviet arms efforts had been used to justify a new and frantic stage in American arms production. They pointed to the alleged deficiency in the number of American bombers at the beginning of the 1950s and also to the alleged deficiency in the number of missiles at the end of the 1950s, both of which were used by the Pentagon to motivate new and gigantic arms expenditures. At a later date even leading politicians and military brasshats as, for example, McNamara, openly admitted that reports of this nature had no verifiable or even verified foundation.

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[1] SIPRI Yearbook of World Armaments and Disarmament 1969/70. Published by Stockholm International Peace Research Institute. 540 pages. Stockholm, London, New York, New Delhi 1970.

Answering a question from Frau R. Riemeck (FRG) regarding the effects of arms expenditure on the development of the USSR, G. V. Trukhanovsky said: "The fact that the Soviet Union is forced to devote considerable expenditure to maintaining defence systems at a level capable of protecting us against unforeseeable events, does, of course, slow down the development in prosperity for the people of the Soviet Union. However, the experiences gained from the imperialist intervention between 1917 and 1922 and from the Great Patriotic War between 1941 and 1945 show that we have acted sensibly in paying much attention to the requirements of defence and in devoting the necessary means to this. The people in the Soviet Union know that the defence measures guarantee the security of the Soviet Union and all the socialist countries."

Referring to K. Ibsen and E. v. Weizsäcker (FRG), who pointed to the high proportion, on average, of the gross national product taken up by arms expenditure in the socialist countries and who demanded that each side should practice "self-criticism" and dismantle the images they had of the enemy, M. Atia (Egypt) stressed, among other things, that the decisive factor was not only the magnitude of arms but also the end they served–attack or defence–a point of view which Frau R. Riemeck (FRG) had also gone into. In this connection M. Atia pointed to one of the two Super Powers which had already used in the past, and was also using at present, B and C weapons in Vietnam, Laos and Cambodia. Replying to this, D. R. Inglis said, "I, as the representative of this nation, only spoke about A weapons. I do not wish to imply that I overlook the importance of doing away with B and C weapons ... I do hope that there will come a time when the B and C weapons will not only no longer be used but also destroyed in the arsenals." There was complete agreement both in assessing the catastrophic effects by the USA's use of chemical weapons in Vietnam as well as in condemning this action so contrary to international law. At the same time the direct and indirect consequences of using B and C weapons, including their genetic effects, were also discussed. P. Cot (France) pointed out in this connection that even those chemical weapons which are intended to simply put the victims temporarily out of action can also have a lethal effect under certain conditions and should, for this reason, be included in a strict and general ban. This also holds true, he went on, for chemicals used by the police against demonstrators, as is the case, for example, in France. P. Stulz and others drew attention to the decisive economic driving forces behind the arms race in the

USA, which no less a person than President Eisenhower himself defined as a military and industrial complex during his farewell speech in January, 1961. These circles, which represented huge monopoly groups, had a direct interest from a profit motive in continually arming, since there is no higher profit to be had than that gained in the arms sector, he added. He went on to say that another of the USA's aims in continually escalating the arms race is to make use of its temporary and historically conditioned superiority in the field of labour productivity and to force the socialist states, in particular the Soviet Union, to invest an equally large and sometimes even larger share of their national income for arming purposes and thus devote resources to a field which is "unproductive" in the narrower sense of the word for the socialist society. The intention behind this unsuccessful policy, he said, had been to economically ruin the USSR and the other socialist states.

Various conference participants, as, for example, J. Kuczynski (GDR), also drew attention to the fact that circles in the USA, which are closely connected with the Pentagon, had declared on innumerable occasions during the past 25 years that it was their aim to wipe the USSR off the map on the basis of their arms superiority. Thus, he said, the Soviet defence force is an unavoidable protective measure and the only answer to this military threat. The touchstone for the correctness or questionability of this thesis was one's attitude to limiting the arms race and to disarmament, he said, and for many years now very concrete proposals made by the Soviet Union had been lying on the negotiating table. It was generally well known, he concluded, which side had placed obstacles in the way of more rapid progress in solving these problems, whether it be a question of banning underground nuclear tests or of conventional disarmament.

While referring to the fundamental differences in the motives for armament in the USA and the USSR, it was pointed out that due to the completely different social order and social objective existing in the USSR, it neither had the slightest interest in making profits from arms nor in conducting a war of conquest. Thus, it was added, it was not correct to talk about "doves" and "hawks" in connection with the USSR. In addition, the opinion was expressed (P. Stulz, GDR) that it was false simply to speak of the "deterrent potential" and of the "necessary balance" between the two super nuclear powers without going into the different motives for these armaments.

The attitude towards disarmament of those working in the USA's arms industry also played a role in the debate. The contention that they would be against an arms reduction from the very beginning was countered with opinions to the contrary. It was stated that if the immense financial resources, which are at present invested in American armaments programmes, were to be used for developing and extending other branches of the economy, then not only would those engaged in arms production but also hundreds of thousands of unemployed people have good opportunities for earning a living. The unions should be won over to fight for this aim, it was concluded.

As regards the various motives for arming, K. Ipsen (FRG) said he personally was of the opinion that the intentions behind the military potential of the socialist states were exclusively peaceful ones, but, he added, "Please try to understand how this military potential is seen not only by the populations of western states but also by the populations of neutral states. This is something I know from wide experience. More often than not this potential is seen only for what it is without the peace-loving intentions behind it being recognized.

... I say this because it seemed necessary to me to point out that it should be our obligation and intention to concentrate on our common interest minimum. In order to prevent human life from being destroyed, it is at the present moment first and foremost necessary to do everything to do away with the swords. When we have done this then we can of course reflect historically on who caused this situation to come about."

In the debate on the armaments policy conducted by the Great Powers at the beginning of the Cold War directly after the Second World War, E. H. S. Burhop (United Kingdom) contradicted the view put forward by D. R. Inglis (USA), that if the USA had revealed the secret of the atom bomb in 1945 this would only have accelerated the arms race. He said: "Do you not think that the post-war arms race could have been avoided if the USSR had been called upon to work on the Manhattan Project together with the USA and the United Kingdom. Instead of this, the bomb was developed, as you know, in strict secrecy towards the Soviet ally with whom we allegedly closely cooperated. In actual fact the shroud of secrecy around the Manhattan Project seemed just as much aimed against our Soviet ally as against the Nazi enemy."

D. R. Inglis admitted that "the American scientists lost control of the project."

During the discussion doubts were raised as to the correctness of the contention by J. Moch (France), that the American Baruch Plan would have lead to genuine disarmament if it had been implemented. It was pointed out that the effect of the Baruch Plan would have been to guarantee the American atom bomb monopoly for all time to come, to bring the world's uranium deposits and all research work in the field of nuclear science under the control of a nuclear energy authority directed by the USA and, in particular, to stop development of Soviet nuclear research. Replying to this, J. Moch stated "The Baruch Plan was not, genuinely speaking, a disarmament plan. This is quite correct. The Soviet objection made at that time–that this was aimed at creating a monopoly for the Americans and that the USA wanted to be the only country possessing atomic weapons–cannot be altogether denied, but the fundamentals of the plan might have made it possible to carry out effective control in the field of disarmament. And especially so in view of the fact that at that time there were no large stockpiles of nuclear weapons. Later on, however, this plan did not have as much value because the nuclear stockpiles had grown larger."

The discussion on this set of problems showed how different were the opinions regarding the causes and driving forces behind the arms race, although there was complete agreement regarding the magnitude of the dangers stemming from ABC weapons and also regarding the necessity to do away with these means of mass destruction. At the same time it showed the earnest endeavours to find the minimum of common interest needed to obtain a step-by-step reduction in present frantic arms stockpiling. It become onee mere visible that any "balance of terror" does not offer any tangible guarantee for the maintenance of peace, indeed, that this places it in danger in view of the arms spiral together with the development of new weapon systems.

Genuine Possibilities for Disarmament and the Scientist's Responsibility

The remarks and supplementary discussion contributions on this theme dealt with questions arising in the struggle for general and complete disarmament which are important for political, economic, social, technical or legal reasons.

The discussion speakers maintained that progress had already been made in curbing the arms race, but that even greater efforts are required in order to implement measures effectively limiting armaments and bringing about disarmament. The ban on testing nuclear weapons in the atmosphere, in outer space and under water, the ban on proliferating nuclear weapons, the ban on stationing means of mass destruction in outer space, on cosmic bodies and on the sea bed, were welcomed and described as useful steps.

Special attention was centred on the proposal put forward by the USSR in the United Nations Organization regarding the convocation of a world conference on disarmament. E. H. S. Burhop (United Kingdom) declared: "If we do not support such a conference, what other proposal would there be which would allow us to advance internationally the cause of disarmament in the field of nuclear weapons and other areas?... The preparations depend, of course, to a large extent on our injecting people with the wish and desire for disarmament, and when we return to our countries we must help develop the demand for a solution to these problems. I believe that we need the pressure of public opinion and we must contribute to creating this pressure."

Important legal problems connected with disarmament were dealt with by P. Cot (France), B. Graefrath (GDR), K. Ipsen (FRG), A. P. Steiniger (GDR), L. Takacs (Rumania) and other conference participants. It was demanded in particular that much attention be paid to holding in check the dangers stemming from B and C weapons and that strict observance of the 1925 Geneva Protocol be numbered among the priority tasks in the endeavours to obtain disarmament. Proceeding from the convention draft already agreed upon dealing with a ban on B weapons, a comprehensive ban on all C weapons was also called for.

Various participants considered an effective control system to be one of the effective measures deemed necessary and possible for putting an end to the arms race and for general and complete disarmament. J. Moch (France) stated in this connection: "Nowadays we see that progress made in seismology has made it possible for recordings to be made over long distances. Information is also to be had from technical journals..., and finally we have electronic data processing–something we did not have before–which makes it possible to classify the millions of pieces of information, to collect them together and thus provide us with an exact picture of the armament or disarmament measures of any country. From this one can draw the conclusion that on-the-spot inspection considered a necessity by the West twenty years ago appears less useful in our present day and age..."

During the discussion of legal problems B. Graefrath (GDR) disagreed with K. Ipsen's view that the set of agreements concluded by the West European Union in 1954 contained a clause binding in international law by which the FRG renounced the production of ABC weapons: "The FRG's renunciation in 1954 of ABC weapons... neither means that ABC weapons are not stationed, tested or developed on FRG territory nor that the FRG renounces control over such weapons, nor that it does not produce such weapons outside Federal German territory... Up till now all the proposals put forward by the GDR regarding a joint renunciation of testing, possessing and producing nuclear weapons have been doomed to fail due to opposition from the FRG."

M. Atia and M. Hamdy (Egypt) and N. Singh (India) spoke on the need and possibilities for disarmament from the point of view of young national states on the African and Asian continent. M. Hamdy stated: "The developing countries, including the Arab Republic of Egypt, desperately need peace and rapid disarmament in the field of ABC weapons. Egypt's scientists expect support from the scientists in Western countries as well. Thus we propose that aggression or occupation of foreign territories not be tolerated since this is closely linked with the arms race."

All in all the discussion proved that measures aimed at limiting armaments, and finally at obtaining general and complete disarmament, are linked with many difficult and complicated questions. However, at the same time it was proved at the conference with many facts that real possibilities exist for solving the problems. It was pointed out that the powers at present in possession of nuclear weapons have a special responsibility for concluding disarmament agreements as regards atomic weapons. A conference of the five Nuclear Powers would pave the way for this.

Some time was devoted to the favourable results stemming from the measures aimed at relaxing tension and bringing about understanding for the success of disarmament endeavours. Such effects would be especially forthcoming from a conference on questions of European security and cooperation. The UNO would fulfill its tasks as regards maintaining and securing peace more effectively if it were to become a really universal organization. If all states were to normalize their relations on the basis of international law this would also lead to a climate favourable to disarmament measures.

It was also stated at the conference that arising from the ban on using or threatening to use force in relations between states, there was a precedent for reaching agreement on disarmament measures. As early as 1961 with its resolution No. 1653 (XVI) the UN General Assembly confirmed that a general ban on using means of mass destruction does exist. The importance of the opinion of by far the larger majority of all international lawyers was stressed, according to which the general norms in international law banning certain types of weapons apply without exception to all A, B and C weapons.

The debate on the scientist's responsibility spread throughout the whole of the conference. This corresponds to the generally accepted view that the scientist may not remain indifferent as regards the application of his scientific discovery, and that as part of society as a whole he also shares responsibility for its fate.

The political engagement of the scientist and his great responsibility were dealt with many times over. P. Cot (France) coined the basic demand that "scientists should not be forbidden to take an interest in political problems." They are in a very good position to judge, for example, the effects of certain military agents and thus they should do all they can in order, with the help of public opinion, international organizations and the working people, to advance further along the road to disarmament. E. H. S. Burhop (United Kingdom) stressed that the arms race had made the situation so grave that scientists must take part in shaking public opinion into action to support the proposed world conference on disarmament.

S. Shibata (Japan) reported that Japanese scientists had constantly demanded from their country's government that it ratify the necessary international protocols and also declare that Japan would not participate in developing, producing, stockpiling and using ABC weapons. However, he added, it was necessary to redouble all efforts in order to attain this aim.

However, at the same time the scientist's engagement and responsibility for the cause of disarmament also means being active and influencing developments. In this connection F. Calogero (Italy) declared: "In politics it is not only a matter of disarming or arming. Politics are not only a technical problem. The way and means of intervening that scientists choose depend upon their personal political outlook. In doing this the scientists must make use of the different mass media existing in the country concerned... Activity can express itself in many different forms."

Following upon this point, G. Page (France) said that advanced science was developing closer and closer relations with production and that its application also had a class character.

F. Calogero (Italy) went on to say that scientists have to be highly qualified and well informed in order to exercise any political influence. They must not only know the ins and outs of the arms race but on the whole be well acquainted with the strategy of argumentation used to defend it. In addition they must also keep up to date with the latest developments in disarmament negotiations. He stated: "At the first glance this seems to be something quite simple. But in Italy it has been our experience—and I believe this is also true for France—that not many scientists really take the trouble to remain in touch with developments. It is much easier for the scientist to take up a so-called purely scientific stand and practically not bother with the political aspects. This is of course due to a certain laziness of thinking. Thus I deem it necessary for scientists to become, as it were, comrades-in-arms of the working class. This is only possible if they are better informed. If they are better informed then they can also become politically more active."

Touching upon the same problem, P. Cot (France) said: "I demand two things of a scientist. First of all, he must join in with the fight in his own country which is aimed at making the state in which he lives to undertake the necessary measures for general disarmament and to take steps towards controlled disarmament. He must support his government in such activity. In his research work he must take the trouble, within the framework of what is possible and despite the division of labour, to contribute to seeing that new discoveries are used for the well-being of mankind."

W. A. Wooster (United Kingdom) supported F. Calogero's opinion as regards keeping oneself well informed, and described the experiences of some scientists in Cambridge. He belonged to a small group of scientists, mostly physicists, who tried to fight against all types of war preparations. When in the course of making preparations of this nature the government suggested certain air-raid precautions, they undertook an investigation into these recommendations from a technical point of view. They found that the members of the Lower House and also the press understood precious little about this complex of problems. Within fourteen days the Cambridge group compiled and published a statement in this connection and their intervention led to the government revising this part of its air-raid precautions. "This is one example", W. A. Wooster concluded, "of what a small group of scientists can do in a certain field if it is well informed."

Another question very much of interest for the scientists was their attitude to participating in producing weapons of mass destruction. C. Penescu (Roumania) was of the opinion that up till now people had always discussed this problem at an academic level, and he put the question as to whether someone directly connected with the development of a means of mass destruction is responsible under international law or not. W. A. Wooster (United Kingdom) maintained that patriotism played a very important role and that the feeling of duty which scientists had towards their country should also be taken into account. He went on: "As far as I understand the situation, during peace at least, each person is subject to the laws of his own country. If it comes to war then international law can, in my opinion, play a role. Thus it is important to make the suggestion that scientists take international law into account."

Referring to the convention adopted at the XXIIth UN General Assembly against limitation of war crimes and crimes against humanity, B. Graefrath (GDR) declared: "This convention contains a sentence which states that responsibility under international law also exists even when, contrary to obligations in international law, the laws in the country concerned do not provide for responsibility of this nature. I think that this is nowadays a general conviction in law."

P. Cot (France) argued that "a scientist might take part in discovering and producing weapons which are banned by international law, but he might be convinced that these weapons will never be used, or only in case of the enemy attacking first. Reprisals to counter certain measures are something sanctioned by international law if the circumstances call for them and if they are kept within certain limits."

E. H. S. Burhop (United Kingdom) was of the opinion that scientists should under no circumstances help in the production of weapons of mass destruction. He continued: "Almost all means of mass destruction are produced within the framework of government contracts. We call upon scientists not to do this. But properly speaking, we should at the same time call upon the governments to stop instigating scientists to do this." E. H. S. Burhop went on to say that scientists also share their great responsibility with other people. He pointed out that "although during basic research one cannot say how something is going to be used, the research motive of most people working on weapons is quite clear." He cited the example of a woman chemist in the USA who received an award for developing a new type of virus capable of destroying rice crops. This, he said, was an example of the large number of cases where the scientist can be in no doubt as to the end served by his research work.

The discussion on this series of problems clearly showed how scientists in countries with imperialist aims are brought into conflict with their conscience, and the ways they try to prevent their scientific findings from being misused for anti-humanitarian aims. Scientists from capitalist countries stressed that their efforts should be aimed at using concrete facts of evidence to show in the scientific institutes what kind of consequences are to be had by militarisation. This could be illustrated by the financial cut-backs in research for peaceful purposes and by the many small questions which touch upon the scientist's life. Thus, B Booss (FRG) stated: "We must unsparingly rid our colleagues of illusions that, for example, only armaments offer possibilities for technological advance and can determine the great research tasks... When our colleagues perceive that here there is a contrast of interests between the forces of peace and the forces who simply profit from armaments, then which sensible colleague would not devote a part of his valuable time to fighting out these questions? The opposite side realised this a long time ago."

For scientists in the socialist countries the responsibility for the development of their peoples and the responsibility for protecting what has already been achieved by parrying any danger threatening from outside, are intertwined with one another. During the discussion, E. Brumme (GDR) reported on the results of an opinion poll among high-school pupils asking them what they expected of a scientist. "They demand political responsibility from the scientist and they demand that research and theory not be rushed into without having a general idea of the actual problems existing in our economy." he said.

Several of those speaking during the discussion urged emphatically that scientists should not be left to lead the struggle for arms limitation and disarmament alone. Disarmament could only be brought about through a tough struggle on the part of the broadest masses of the people, a struggle which cannot be separated from the working class fight to change society. M. Delsal (France) said: "The working class has an especially deep interest in the topic of this conference. It has united in national and international organizations... in order to prevent preparations for a Third World War, in order to counter the armament policy of the capitalists and in order to help guarantee lasting peace."

J. M. Legay (France) concluded from this that scientists must act as a specific group in close conjunction with the organizers of other social groups, and that in this the organizations of the working class–which is especially interested in maintaining peace–should occupy the leading position. The World Federation of Scientists, he went on, would have to decide on a positive way of approaching this problem, would have to introduce clarity into its analysis and prepare certain actions. If it decided to take an individualistic course that leads to an exclusively moral conception of the scientist's responsibility and thus grants scientists a very special position in society, then it would be pursuing the policy of a group of more or less famous personalities on which one counts to awaken the interest of public opinion through sporadic anarchistic and often brilliant acts. If the Federation were to take the collective path then it would have to pursue a genuine policy of uniting together based on the impact of the organizations thus united together, a policy which would have to support and coordinate the actions of national organizations and which would have to take into account the specific conditions under which these organizations operate in the different countries. In conclusion he said: "The World Federation of Scientists has the unique opportunity of combining both forms of struggle with each other; the individual form, which can be suitable for certain persons and under certain social and cultural conditions; and the collective form, which of necessity covers the majority of scientists."

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